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COLOR DISPLAY

ICD451B

Technical Manual

MC-Service

SERVICE SAFETY PRECAUTIONS

WARNING: X-RADIATION

X-RADIATION CAN BE CAUSED IF CRITICAL COMPONENTS ARE REPLACED BY NON-CONFORM COMPONENTS. THESE COMPONENTS ARE MARKED IN THIS SERVICE MANUAL BY AN *.

WARNING: SAFETY

ELECTRIC SHOCK OR FIRE HAZARD CAN BE CAUSED IF CRITICAL COMPONENTS ARE REPLACED BY NON-CONFORM COMPONENTS. THESE COMPONENTS ARE MARKED IN THIS GUIDE BY A ⚠ SIGN.

REPLACE WITH CONFORM TYPES ONLY!

1. Comply with all caution and safety-related notes on or inside the instrument cabinet, on the chassis, or on the picture tube.

2. When service is required, maintain correct lead dress and parts placement. Extra precaution should be taken to assure proper lead dress in the High Voltage circuit area.
Where a malfunction has occurred, those components or circuits that indicate evidence of abnormality should be replaced or corrected. Always use the manufacturer's safety specified replacement components.

3. Do not remove, install or handle the picture tube in any manner unless shatter-proof goggles are worn. People not so equipped should be kept away when picture tubes are handled. Keep the picture tube away from the body while handling.

4. Protective shields are provided on this chassis for the protection of both the service technician and the costumer.
Protection shields removed for service convenience must be re-installed correctly and ANY MISSING SHIELD MUST BE REPLACED. DO NOT OPERATE THIS INSTRUMENT WITHOUT THE PROTECTIVE SHIELDS IN POSITION AND PROPERLY SECURED.

5. After any service intervention, the service technician must be sure that no protective device built into the instrument by the manufacturer has become defective, or inadvertently defeated during servicing. Therefore, the following checks are recommended for the continued protection of the costumer and service technician.

GROUNDING CONTINUITY TEST

- Remove main plugs from wall outlet.

- With an Ω-meter in its lowest resistance range, measure resistance between the grounding prong of the mains plug and all accessible conductive parts.
THE METER MUST BE READ ZERO OHM.

- The mains plug still being removed from the wall outlet, switch on the instument.
- Switch an Ω-meter in its highest resistance range, measure resistance between the grounding prong of the mains plug and the two other prongs of the mains plug.
BOTH METER READINGS HAVE TO BE MORE THAN 5 MEGOHM (5 MΩ).
ANY MEASUREMENTS NOT WITHIN THE LIMITS OUTLINED ABOVE, THE INDICATIVE OF A POTENTIAL SHOCK HAZARD AND CORRECTIVE ACTION MUST BE TAKEN BEFORE RETURNING THE INSTRUMENT TO THE COSTUMER.

X-RADIATION AND HIGH-VOLTAGE LIMITS

The primary source of X-radiation in solid state display units is the picture tube. The picture tube is specially constructed to limit X-radiation emissions. The shields and mounting hardware for picture tubes have an X-radiation protection function and must be properly in place.
For continued X-radiation protection, the replacement tube must be the same type as the original, including suffix letter. High voltage is maintained within specified limits by the use of close tolerance safety related components/ adjustments in the power supply circuit. Refer to the technician X-radiation warning note on the Chassis Schematic and Instrument Labels in the Basic Service Data for specific high-voltage limits of each chassis and X-radiation Protection Circuits. If high voltage exceeds specified limits, check each component specified in the chassis schematic diagram and take necessary corrective action.

PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in display units have special safety-related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by then necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this Data and its Supplements and Bulletins. Electrical components having such features are identified by ⚠ or * on the schematics and on the parts lists in this Data and its Supplements and Bulletins. The use of a substitute replacement which does not have the same safety characteristics as the recommended replacement part shown in the parts lists in this Data and its Supplements and Bulletins, may create shock, fire, or excessive X-radiation.

IMPORTANT NOTE FOR USERS IN THE UNITED KINGDOM:

The wires of the mains lead are coloured in accordance with the following code:
Green and Yellow : EARTH
Brown : NEUTRAL
Blue : LIVE

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:
- The wire which is coloured Green and Yellow must be connected to the terminal in the plug which is marked by the letter E of by the safety earth symbol ⏚ or coloured Green and Yellow.
- The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Black.
- The wire which is coloured Brown must be connected to the terminal which is marked with the letter L or coloured Red.

WARNING: This apparatus must be earthed.

NOTE: This equipment has been tested and found to comply with the limits of a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

DIESES TECHNISCHE HANDBUCH SOLLTE SORGFÄLTIG GELESEN WERDEN BEVOR DIE NETZSPANNUNG ANGELEGT WIRD

ACHTUNG RÖNTGENSTRAHLUNG !!

ERHÖHTE RÖNTGENSTRAHLUNG KANN VERURSACHT WERDEN, WENN BESTIMMTE BAUTEILE DURCH TEILE ERSETZT WERDEN DIE NICHT DER SPEZIFIKATION DES HERSTELLERS ENTSPRECHEN. SOLCHE BAUTEILE SIND IN DIESER WARTUNGSANLEITUNG DURCH EIN * GEKENNZEICHNET.

ACHTUNG SICHERHEIT !!

WERDEN BESTIMMTE BAUTEILE DURCH TEILE ERSETZT, DIE NICHT DER SPEZIFIKATION DES HERSTELLERS ENTSPRECHEN, SO KANN EIN ELEKTRISCHER SCHLAG ODER BRANDGEFAHR DIE FOLGE SEIN. SOLCHE BAUTEILE SIND IN DIESER WARTUNGSANLEITUNG DURCH EIN ⚠ GEKENNZEICHNET.

WARTUNG

VOR DEM ÖFFNEN DES MONITORS IST DIESER AB ZU SCHALTEN !

1. Sämtliche Sicherheitsvorschriften auf der Außen- oder Innenseite des Gerätes bzw. auf der Bildröhre sind zu beachten.

2. Ist eine Wartung erforderlich, so ist die richtige Verdrahtung und die korrekte Einbaulage der Teile zu beachten.
   Es ist besonders darauf zu achten, daß im Hochspannungsbereich eine korrekte Lage gewahrleistet bleibt. Nur solche Ersatzteile verwenden, die der Spezifikation gemäß den Sicherheitsvorschriften des Herstellers entsprechen.

3. Vor dem Ausbau der Bildröhre ist die Anodenleitung und die Anode der Bildröhre gegen den Chassisrahmen zu erden, damit eine vorhandene Ladung abgeleitet werden kann.
   Beim Aus- oder Einbau oder bei sonstiger Handhabung der Bildröhre muß eine Schutzbrille getragen werden. Wer keine derartige Schutzbrille trägt, darf sich nicht in den Bereich aufhalten, wo Bildröhren gehandhabt werden. Bildröhren sind bei ihrer Handhabung vom Körper weg zu halten.

4. Nach erfolgter Wartung muß der Kundendiensttechniker sicher sein daß während der Wartung keine vom Hersteller eingebaute Schutzvorrichtung beschädigt oder unabsichtlich zerstört wurde.
   Es empfiehlt sich daher, zum Schutz der Kunden und des Technikers folgende Kontrollen durchzuführen:

SCHUTZLEITERANSCHLUß UND BERÜHRUNGSCHUTZ

- Netzstecker aus der Steckdose ziehen.
- Mit einem auf kleinsten Widerstandsbereich eingestellten Ohmmeter den Widerstand zwischen der Erdung des Netzsteckers und allen zugänglichen leitenden Teilen messen.
  AM OHMMETER MUß < 0.1 OHM GEMESSEN WERDEN.

- Bei weiterhin gezogenem Netzstecker, das Gerät einschalten.
- Mit einem auf höchsten Widerstandsbereich eingestellten Ohmmeter den Widerstand zwischen der Erdung des Netzsteckers und den beiden anderen Stiften des Netzsteckers messen.
  ES MÜSSEN JEWEILS MEHR ALS 5 MEGOHM ABGELESEN WERDEN.

ERGEBEN DIE MESSUNGEN ABWEICHENDE WERTE, SO KÖNNTE DAS AUF EINE GEFÄHRLICHE BERÜHRUNGSSPANNUNG HINDEUTEN, SODAß ABHILFE GESCHAFFEN WERDEN MUß, BEVOR MAN DAS GERÄT DEM KUNDEN ZURÜCKGIBT.

Die Bildröhre ist Hauptverursacher von Röntgenstrahlung. Sie hat eine besondere Bauform um die Röntgenstrahlung auf ein Mindestmaß zu begrenzen.
Die Ersatzröhre muß vom gleichen Typ sein wie die Originalröhre, damit ein dauerhafter Schutz vor Röntgenstrahlen gewahrleistet ist.
Durch den Einbau von besonders maßgenauen Sicherheits Bauteilen / Abgleichungen im Netzteil wird die Hochspannung innerhalb der angegebenen Grenzwerte gehalten.
Die für Techniker bestimmte warnende Hinweise im Schaltbild, bezüglich der Röntgenstrahlung sowie die bei jedem Gerät aufgeführten Hochspannungsgrenzwerte sind zu beachten.
Liegen die Hochspannungswerte über den dort aufgeführten Höchstwerten, so muß jedes im Schaltbild spezifizierte Bauteil kontrolliert- und die nötige Abhilfe geschaffen werden.

Viele elektrische und mechanische Teile haben besondere Sicherheitsmerkmale. Bauteile die zu dieser Sicherheitskategorie gehören sind in den Schaltbildern und in der Stückliste dieser Wartungsanleitung sowie in den Nachträgen und Technischen Informationen mit einem ⚠ bzw. * versehen.
Der Einsatz von Ersatzteilen, die nicht den Sicherheitsauflagen, denen die Ersatzteile der Stückliste dieser Anleitung, der dazugehörigen Nachträge und technischen Informationen unterliegen, genügen, kann einen elektrischen Schlag, Brand oder eine übermäßige Röntgenstrahlung zur Folge haben.

ACHTUNG : DIESES GERÄT MUß GEERDET WERDEN !!

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CAUTION: HIGH VACUUM PICTURE TUBE

IS DANGEROUS TO HANDLE. REFER PLACEMENT TO QUALIFIED SERVICE PERSONNEL.

EMPLOYS X-RADIATION AND INTEGRAL IMPLOSION PROTECTION. REPLACE WITH A TUBE OF THE SAME TYPE NUMBER AND SUFFIX FOR CONTINUED SAFETY.

X RADIATION WARNING

REPLACEMENT OF CRITICAL COMPONENTS OF THIS APPARATUS (PICTURE TUBE AND OTHERS) CAN RESULT IN EXCESSIVE X RADIATION. THESE COMPONENTS ARE MARKED IN THE SERVICE MANUAL BY AN * .
- REPLACE ONLY WITH CONFORM TYPES;
- SEE SERVICE MANUAL FOR HIGH VOLTAGE ADJUSTMENTS INSTRUCTIONS.

CAUTION: TO DETERMINE THE PRESENCE OF HIGH VOLTAGE, TUBE HIGH VOLTAGES MUST BE DISCHARGED TO CHASSIS.

ACHTUNG

Diese in diesem Gerät entstehende Röntgenstrahlung ist ausreichend abgeschirmt.
Beschleunigungsspannung maximal kV.
Ersatz bestimmter Bauteile kann erhöhte Röntgenstrahlung verursachen.
Diese bauteile sind deshalb in der Bedienungsanleitung mit einen * gekennzeichnet. Nur durch baugleiche Bauteile zu ersetzen!
Zulaß. Nummer: BW/ / /Rö

Serial number: **Beam current:**

Date: **EHT:**

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GENERAL INFORMATION

The ICD451B is a very high quality colour display locking on scan frequencies between 15kHz and 36kHz. The unique design, guaranteeing perfect picture display, together with accurate colour stability and a high contrast picture tube makes the ICD451B the best monitor of its kind. Additionally, the bi-scan system allows multi-frequency use without compromising the geometry. Process control, image processing and sophisticated CAD are amongst the applications that require highly reliable equipment such as the ICD451B.

Main features:

- Resolution : 1280 X 1024
- Dual horizontal and vertical scan frequency possible : scan A/scan B.
  horizontal scanning range : from 15 kHz to 36 kHz
  vertical scanning range : from 45 Hz to 80 Hz
- 20" high contrast CRT with anti-reflective coating
- Remote control for user controls available.

Versions:

- Cabinet version including a tilt & swivel base
- Industrial version for use on factory floor and in non-office environments.
- Chassis version for integration in equipment bay.
- Rack mount version for integration in every 19" rack.

Options:

- Ambient light controller
- Universal latitude corrector
- Bifos®

Changes in this information are possible due to manufacturing, design or traceability to safety regulations.

PRECAUTIONS

Avoid direct ray of light into the CRT.

Provide a proper ventilation area around the display.

Avoid magnetic fields in the neighbourhood to prevent CRT colour impurity.

Keep the display away from heat generating equipment.

ABOUT THE "ICD451B" BOOKS

Every colour display is provided with an user manual.

Use the technical manual for service, maintenance and readjustment of your display.

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CHAPTER 1 : TECHNICAL SPECIFICATIONS

1. Visual performance

- *Picture tube*

  20"(19V) 0.31 mm pitch CRT
  High resolution in-line gun, dotted screen type, black matrix
  Faceplate transmission: 52% NP, 85% LP/SB
  Faceplate treatment: non glare

- *Light output*

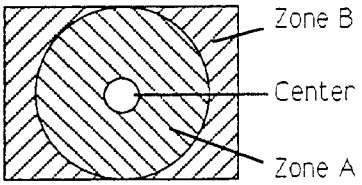
  Calibrated: 60 Nit (Cd/m2)
  Maximum short term: 120 Nit (Cd/m²) for NP CRT, 100Nit (Cd/m²) for LP/SB CRT.

- *Resolution*

  Adressable pixels: 1280 x 1024

- *Convergence specifications*

  Center : 0.15 mm maximum
  Zone A : 0.30 mm maximum
  Zone B : 0.45 mm maximum



- *Raster regulation*

  better than 1% (0-100% APL)

2. Video performance RGB drive

- *Frequency response (-3 dB)*

  45 MHz nominal

- *Pulse rise and fall time*

  maximum 12 ns

3. Calibration spec: signal processing

- *Clamping circuits*

  Back porch or sync tip clamping: jumper selection
  Black level stability: 1% (0-100% APL)

- *White reference*

  Factory aligned to 9300 K for NP CRT version, aligned to 6500 K for LP / SB (can be preadjusted to any colour temperature between 5000 K and 10000 K)

4. Calibration spec: colourimetric performance

- *Phosphor coordinates (x,y CIE1931)*

NP	red	x = 0.610	y = 0.342
	green	x = 0.298	y = 0.588
	blue	x = 0.151	y = 0.064
LP/SB	red	x = 0.620	y = 0.330
	green	x = 0.210	y = 0.672
	blue	x = 0.151	y = 0.064

5. Scanning systems

- *Dual horizontal and / or vertical scan frequency possible : scan A/scan B.*

- *Scan A or B can be selected automatically according to :*

  1. horizontal frequency (scan A = lowest frequency ; min $\Delta fH = 2$ KHz)
  2. vertical frequency (scan A = lowest frequency ; min $\Delta fV = 5$ Hz)
  3. vertical sync polarity
  4. remote (RS232 or external switch)

  (selection 1,2,3,4 b.m.o. internal switch)

- *Horizontal scanning frequency range :*

  15 to 36 kHz divided in five parts :

  15 - 17.9 kHz
  17.9 - 21.3 kHz
  21.3 - 25.4 kHz
  25.4 - 30.2 kHz
  30.2 - 36 kHz

- *Vertical scanning frequency range :*

  45 to 80 Hz divided in two parts :

  45 - 65 Hz
  65 - 80 Hz

  Any frequency between 45 and 120 Hz acceptable by hardware modification.

- Minimum accepted horizontal blanking: 5 µs
  Minimum accepted vertical blanking: 500 µs (after leading edge of sync)

- *Adjustments separated for scan A/scan B :*

  * horizontal & vertical size
  * horizontal & vertical frequency
  * horizontal phase
  * vertical linearity
  * vertical delay
  * horizontal blanking left and right
  * vertical blanking
  * vertical amplitude

- *Adjustments common to both scan A and scan B :*

  * horizontal shift
  * vertical shift
  * skewing
  * trapezium correction

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* parabola correction
* horizontal linearity
are optimized on scan, with priority chosen by customer.

6. Geometry

Maximum geometric error ; max. ± 1.5 % of the picture height within a:
360 x 270 mm scan area (4:3 aspect ratio) or
350 x 280 mm scan area (5:4 aspect ratio)

7. Controls

- *Background*

Dual button control for increase, decrease and calibration, central led indicator illuminates if calibrated and flashes if function is used.

- *Picture*

Dual button control for increase, decrease and calibration, central led indicator illuminates if calibrated and flashes if function is used.

NOTE : At power-on the built-in microcontroller copies the power-on values of two calibration potentiometer settings which are accessable at the rear.

- *Degauss*

Push button, initiates a full degaussing cycle, automatic degaussing at power-on.

Power on

Led indicator, illuminates if display is switched on.

- *Ready*

Led indicator, illuminates if display is working, will be unlit in fail safe mode.

8. Inputs

- *Video signal inputs*

Looped through, BNC type
Impedance: 75 Ω ± 1% if terminated
5 kΩ if not terminated
Level (AC) coupled input:
composite: 1.0 Vpp (± 3 dB)
non composite : 0.7 Vpp (± 3 dB)
Corresponds to RS343 standard
Polarity: positive bright
Receptacles at rear of display

- *Sync signal inputs*

Looped through, BNC type
Composite horizontal & vertical or separate, selection by external switch, polarity selection by internal switch .
Impedance : 75 Ω ± 1% if terminated
4 KΩ if not terminated
Level external : 1.0 Vpp - 6.0 Vpp
Internal (on green) : 0.2 Vpp - 0.5 Vpp
Corresponds to RS170/RS343 standard
Receptacles at rear of display

- *Communication input*

RS232(V24) compatible
9-pin sub-D connector
RX/GND
8 bit + startbit + stopbit
Baudrate : 9600
Code : ASCII
Emulates the front panel control for remote control including SCAN A / SCAN B switching.
Full spec on communication link available on request.

9. Safety regulations

Units are designed to comply with :
DHHS 21, West-German X-ray law
IEC 950
UL 1950
CSA 950
FCC Vol II part 15 subpart J
VDE 0871/0875 class B
Approval details available on request.

10. Power supply

Switched mode high yield type
AC 115 V or 230 V (± 15%), selection by hardware
Mains frequency : 45 Hz to 65 Hz
Power consumption : 145 Watt nominal at 100% APL and calibrated position, nominal input
Mains cable Euro- or US-type included in packaging

11. Environmental

- *Temperature range*

Chassis version :

-20°C	+80°C	storage
+10°C	+45°C	operation
+10°C	+35°C	within calibration spec.

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Cabinet version:

-20°C	+70°C	storage
+10°C	+40°C	operation
+10°C	+30°C	within calibration spec.

- *Altitude*

Storage: 25000 ft maximum
Operational: 10000 ft maximum

- *Humidity*

Operation up to 90% relative humidity, non-condensing

13. Mechanical versions

Chassis version, weight: 36 kg
Cabinet version, weight: 37 kg, tilt & swivel base included in packaging
Rack mount version, weight: 39 kg
Industrial version : 41 kg
(complete mechanical drawings available on request)

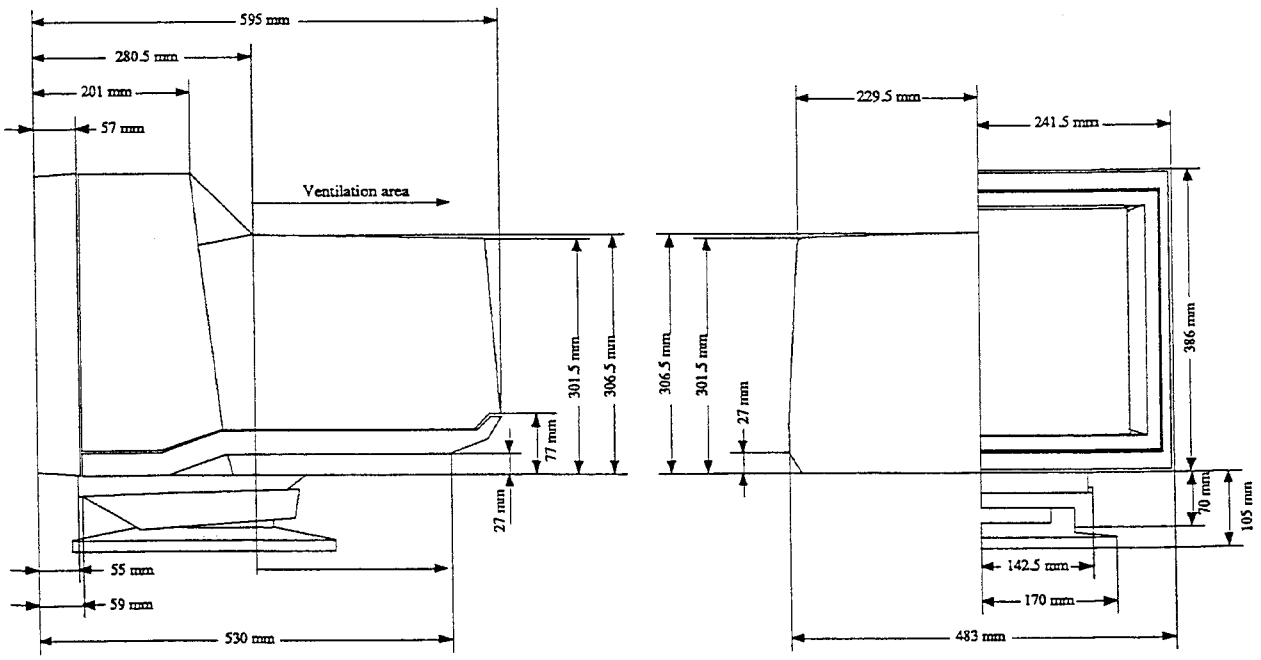
14. MTBF

30000 hours at ground benign 25°C

15. Dimensions

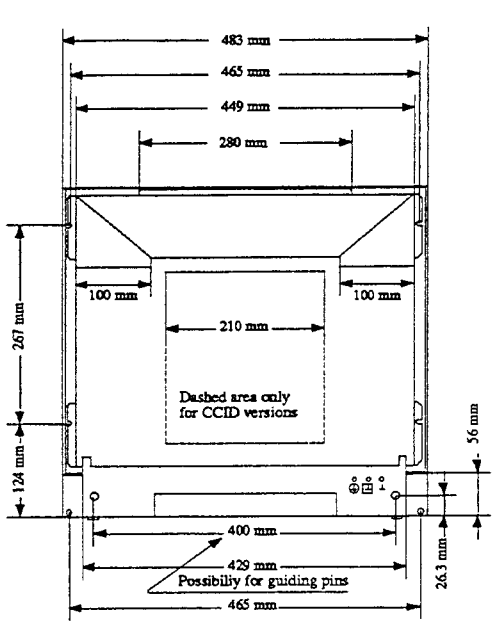
Dimensions cabinet version

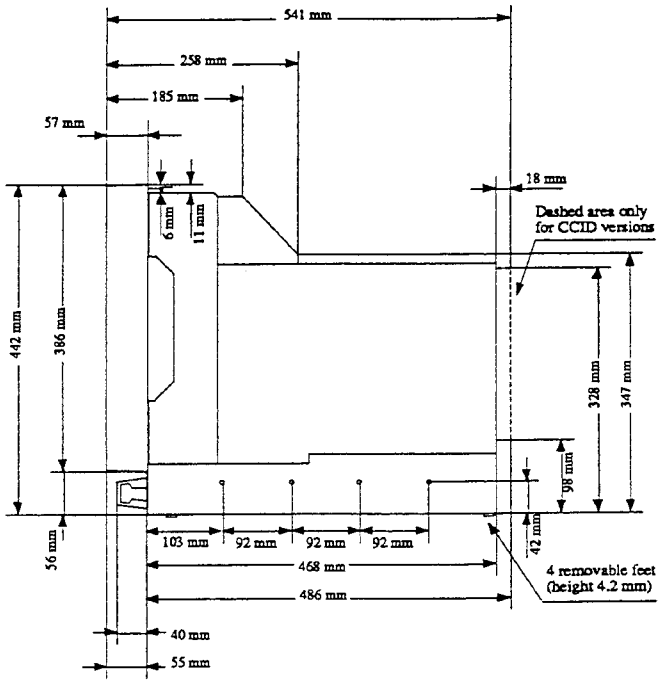
25.4 mm = 1 inch



Dimensions rack version

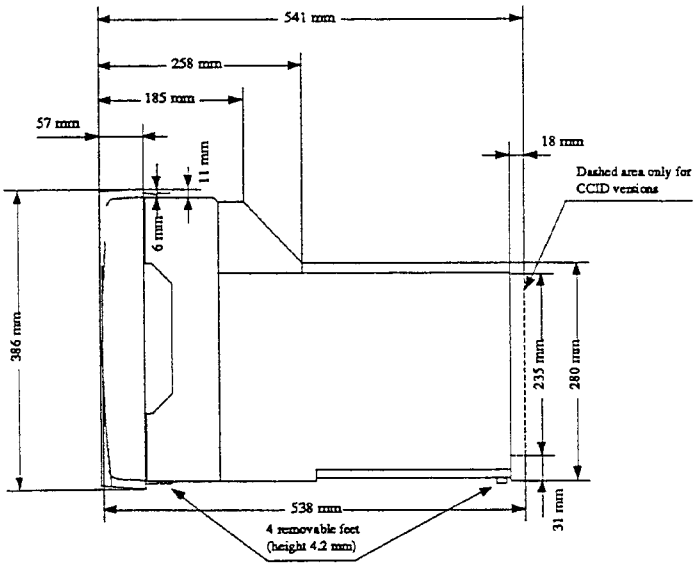
25.4 mm = 1 inch

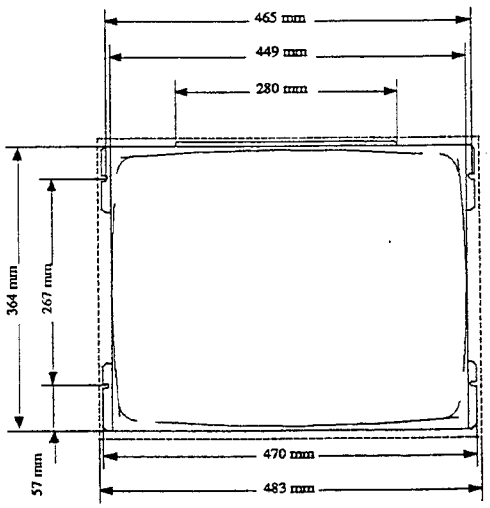




Dimensions chassis version

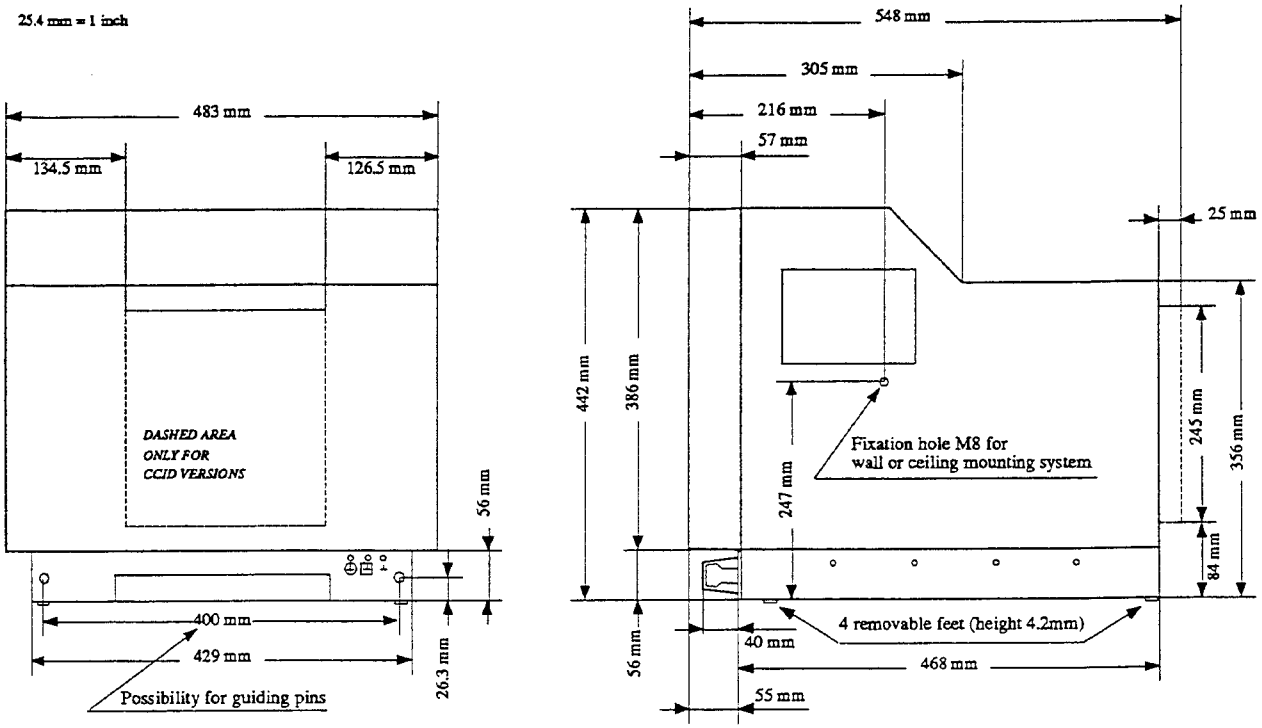
25.4 mm = 1 inch





Dimensions industrial version

25.4 mm = 1 inch



Technical specifications are subject to change due to technological progress.

CHAPTER 2 : SCHEMATICS - DESCRIPTIONS - PARTS LISTS

INTRODUCTION

Each diagram in this manual is identified by means of a character printed in a box in the right hand corner.

One unit or board can be drawn on several schematic diagrams. In this case a composed number, followed by a title, will give the diagram number and how many diagrams are used.
Example : "1/3 RGB IN/OUTPUT" means the first of the 3 diagrams of the RGB IN/OUTPUT unit.

Outside the diagram and in the same corner one can find the unit number with its modification index, followed by " Modifications reserved" and the date of the latest revision.
Example : V5628830/07 Modifications reserved 290589, which means that the order number for a complete " SWITCHED MODE AND EHT POWER SUPPLY" board is V5628830 and that modification index 07 is used as reference for diagram and parts list on date 290589.

UNIT AND BOARD NUMBERS - NAME - IDENTIFICATION CHARACTER

V5629431	Switched Mode and EHT Power Supply	P
V5629410	RGB In/Output and Remote Control	A
V5629400	H & V deflection + Sync	D
V5628850	Control (operation) Panel	O
V5628822	CRT socket	T

UNIT AND BOARD LOCATION

Figure 2.1 (on the next page) shows the location of the different units and boards in the ICD451B display.

WARNING

Never remove units or boards while the display is connected to the mains.

To reach all the boards, the cover and one or more metallic shields have to be removed.

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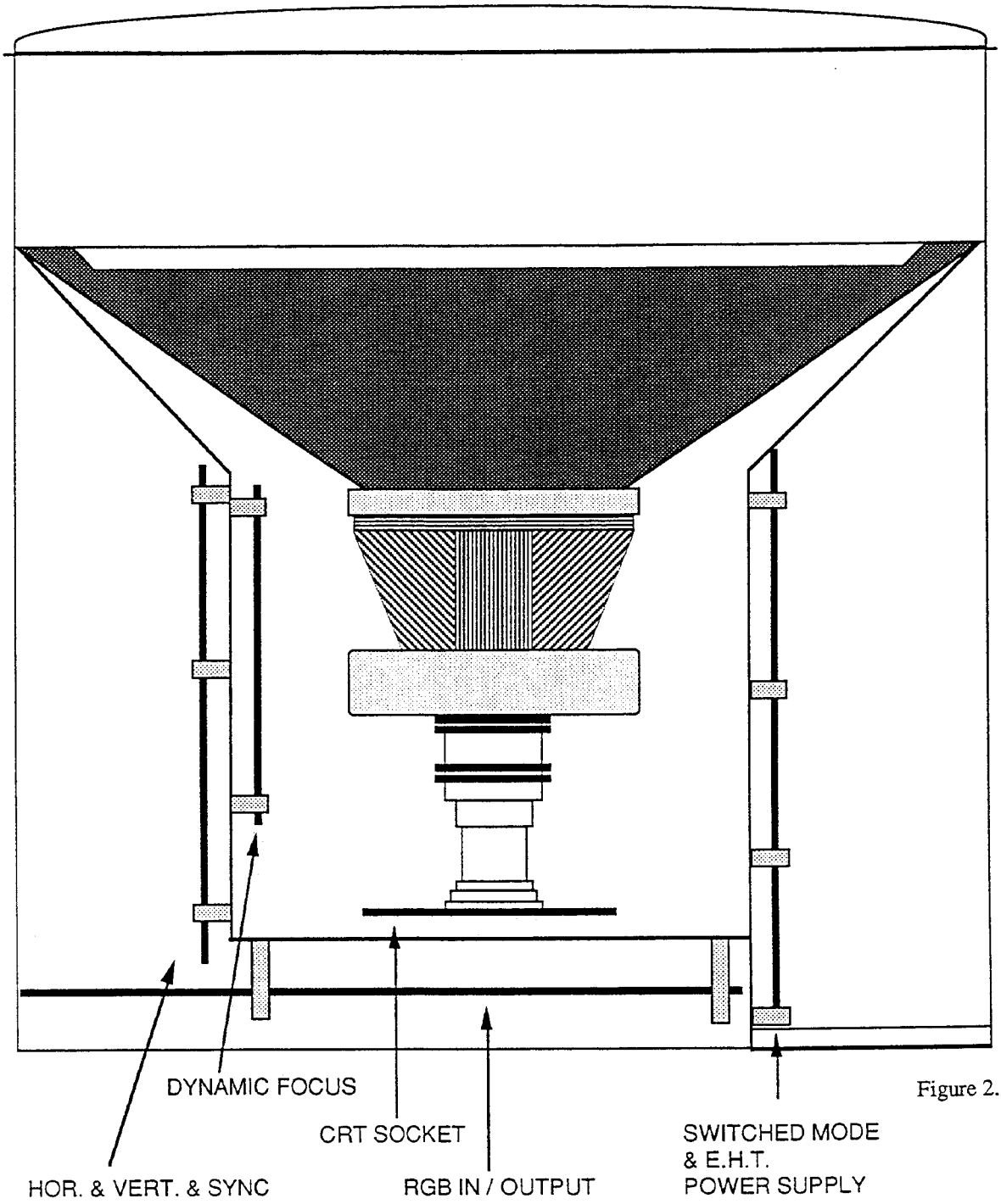


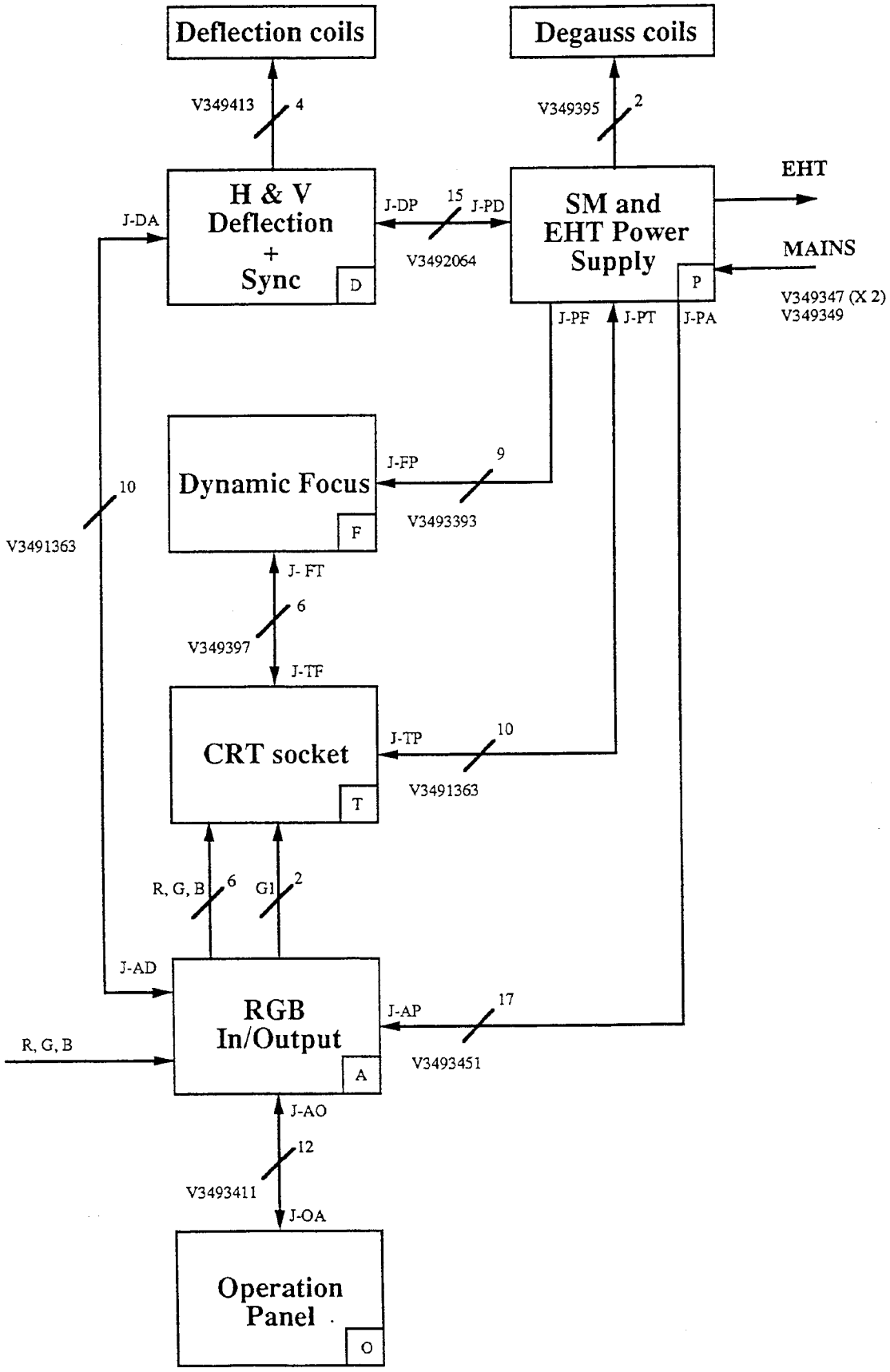
Figure 2.1

HOW TO USE DIAGRAM CONNECTIONS

The boards have different connectors and are named according to their destination. The boards are interconnected by wired plugs which have a different quantity of pins and also a key to prevent wrong connections. The first diagram will show you the wiring cables between the different boards. Each wiring cable is identified by a character, an indication of the quantity of wires used in this cable and the name of the two connectors on the two boards.

Because of surveyability, links on the diagrams itself or between more diagrams of the same board are indicated by . Every symbol is provided with an explanatory text which is listed at the end of this section.

WIRING DIAGRAM ICD451B



HOW TO USE PARTS LISTS

GENERAL

Each parts list starts with the reference to the unit and the unit name. The next line gives the company order number of the complete unit. The next line gives the column headings : ORDER NUMBER, DESCRIPTION and ITEM.

The ORDER NUMBER is the company order number.
Safety components are marked with ! , critical components concerning radiation with a * sign.
The DESCRIPTION is a coded description of the component. See paragraph CODE DESCRIPTION for more info.
The ITEM column gives the component location or a description of the mechanical parts and/or the quantity (QTY:).

XXXXXXXXXXXXXXXXXXX

A B C D

CODE DESCRIPTION

The component description for resistors and capacitors consists of 4 groups of characters with a total quantity of maximum 19 characters.

GROUP A: This group of maximum 7 characters gives the component code described in paragraph CODED TO COMPONENTS.
e.g. CPOMEPO: potted metal polyester capacitor.

GROUP B: This group of maximum 6 characters gives the component value.
e.g. 3K3 kilo Ω for resistors.
e.g. 3.3 nanofarads for capacitors.

GROUP C: The tolerance code, given with one characters and listed in paragraph TOLERANCE CODES.

GROUP D: This group of maximum five characters gives the maximum permissible power dissipation for resistors and the limiting voltage for capacitors.
e.g. 0.25 for resistors means 0.25W.
e.g. 63 for a capacitor means 63V.

CODES TO COMPONENTS

CCEDI	CAPACITOR VERTICAL MOUNTED
CCEMI	CAPACITOR CERAMIC MINIATURE
CELAX	CAPACITOR ELECTROLYTIC AXIAL
CELBI	CAPACITOR ELECTROLYTIC BIPOLAR
CELPR	CAPACITOR ELECTROLYTIC PRINTED CIRCUIT
CELSN	CAPACITOR ELECTROLYTIC SNAP IN
CFDTRH	CAPACITOR FILM DIELECTRIC TRIMMER HORIZONTAL MOUNTING
CFDTRV	CAPACITOR FILM DIELECTRIC TRIMMER VERTICAL MOUNTING
CMAINS	CAPACITOR Y MAINS
CNPOMI	CAPACITOR CERAMIC CLASS 1 TEMP COEFF NPO MINIATURE
CN750	CAPACITOR TEMP COEFF N750
COIL LIN	COIL LINEARITY
CON DIL	CONNECTOR DUAL IN LINE
CONFOBSE	CONNECTOR FEMALE ON BOARD SIDE ENTRANCE
CONFOC	CONNECTOR FEMALE ON CHASSIS
CONMOBTE	CONNECTOR MALE ON BOARD TOP ENTRANCE
CONMOW	CONNECTOR MALE ON WIRE
CONSNAP	CONNECTOR SNAP WIRING
CPCPO	CAPACITOR POLYCARBONATE PTTED
CPOMEFF	CAPACITOR POLYESTER METAL FILM FOIL
CPOMEPO	CAPACITOR POLYESTER METAL POTTED
CPOPO	CAPACITOR POLYESTER SAVE POTTED
CPPPR	CAPACITOR POLYPROPYLENE PRINTED CIRCUIT
RMCE	RESISTOR GROUP MULTITURN POTENTIOMETER CERAMIC
RRCF	RESISTOR GROUP CARBON FILM
RRCFF	RESISTOR GROUP CARBON FILM FUSING
RRHOLDER	RESISTOR GROUP RESISTANCE HOLDER
RRMF	RESISTOR GROUP RESISTOR METAL FILM
RRMO	RESISTOR GROUP RESISTOR METAL OXIDE
RRPTC	RESISTOR GROUP RESISTOR POSITIVE TEMP COEFF
RRWW	RESISTOR GROUP RESISTOR WIRE WOUND
RRWWH	RESISTOR GROUP RESISTOR WIRE WOUND HORIZONTAL
RTCEMV	RESISTOR GROUP TRIM POTENTIOMETER CERANMIC MINIATURE VERT
RMCEM	RESISTOR GROUP MULTITURN POTENTIONMETER CERAMIC MINIATURE
RTCEMH	RESISTOR GROUP TRIM POTENTIOMETER CERAMIC MINIATURE HOR
RTWW	RESISTOR GROUP TRIM
SMCDIO	SEMICONDUCTOR DIODE
SMCDIOLED	SEMICONDUCTOR DIODE LED
SMCDIOREC	SEMICONDUCTOR DIODE RECTIFIER
SMCDIOVAR	SEMICONDUCTOR DIODE VARICAP
SMCDIOZEN	SEMICONDUCTOR DIODE ZENER
SMCIC	SEMICONDUCTOR INTEGRATED CIRCUIT
SMCIDL	SEMICONDUCTOR INTEGRATED CIRCUIT LINEAR
SMCICLOPA	SEMICONDUCTOR INTEGRATED CIRCUIT LINEAR OPERATIONAL AMPLI
SMCICCMOS	SEMICONDUCTOR INTEGRATED CIRCUIT CMOS
SMCICLVOL	SEMICONDUCTOR INTEGRATED CIRCUIT LINEAR VOLTAGE
SMCPOWFED	SEMICONDUCTOR POWER FET
SMCTHY	SEMICONDUCTOR THYRISTOR
SMCOPTCOU	SEMICONDUCTOR OPTO COUPLER
SMCTRA	SEMICONDUCTOR TRANSISTOR
SMCTRA CLIP	SEMICONDUCTOR TRANSISTOR CLIP
SMCTRAFIX	SEMICONDUCTOR TRANSISTOR FIXER
SMCTRACOOLER	SEMICONDUCTOR TRANSISOTER HEATSINK
SMCTRAPOW	SEMICONDUCTOR TRANSISTOR POWER
SMCTRA ISO	SEMICONDUCTOR TRANSISTOR INSULATION

MC-Service

TRF CUR	TRANSFORMER CURRENT SENSING
TRF SHIFT	TRANSFORMER SHIFT
TRF DRIV	TRANSFORMER DRIVER

TOLERANCE CODES

CHARACTER	CAPACITOR/RESISTOR TOLERANCE	CHARACTER	CAPACITOR/RESISTOR TOLERANCE
A		N	±30%
B	±0.1%	P	+100%, -0%
C	±0.25%	Q	+30%, -10%
D	±0.5%	R	+30%, -20%
E		S	+50%, -20%
F	±1%	T	+50%, -20%
G	±2%	U	+80%, -0%
H	±2.5%	V	+100%, -10%
J	±5%	W	+20%, -0%
K	±10%		

HOW TO ORDER SPARE PARTS

To place an order for spare units, boards or components directly from Barco Video & Communications, contact our Customer Service Group and specify the required parts as follows :

1. The coding of the component according to the circuit diagram.
2. A brief description of the component.
3. The order number in the parts list.
4. The sub-unit it makes part of.
5. The display type and version.
6. Serial number and revision state.

SYMBOLIC

Resistor values in „Ohm"

Examples: 4.7 = 4.7 Ohm

4K7 = 4.7 kOhm = 4 700 Ohm

4M7 = 4.7 MOhm

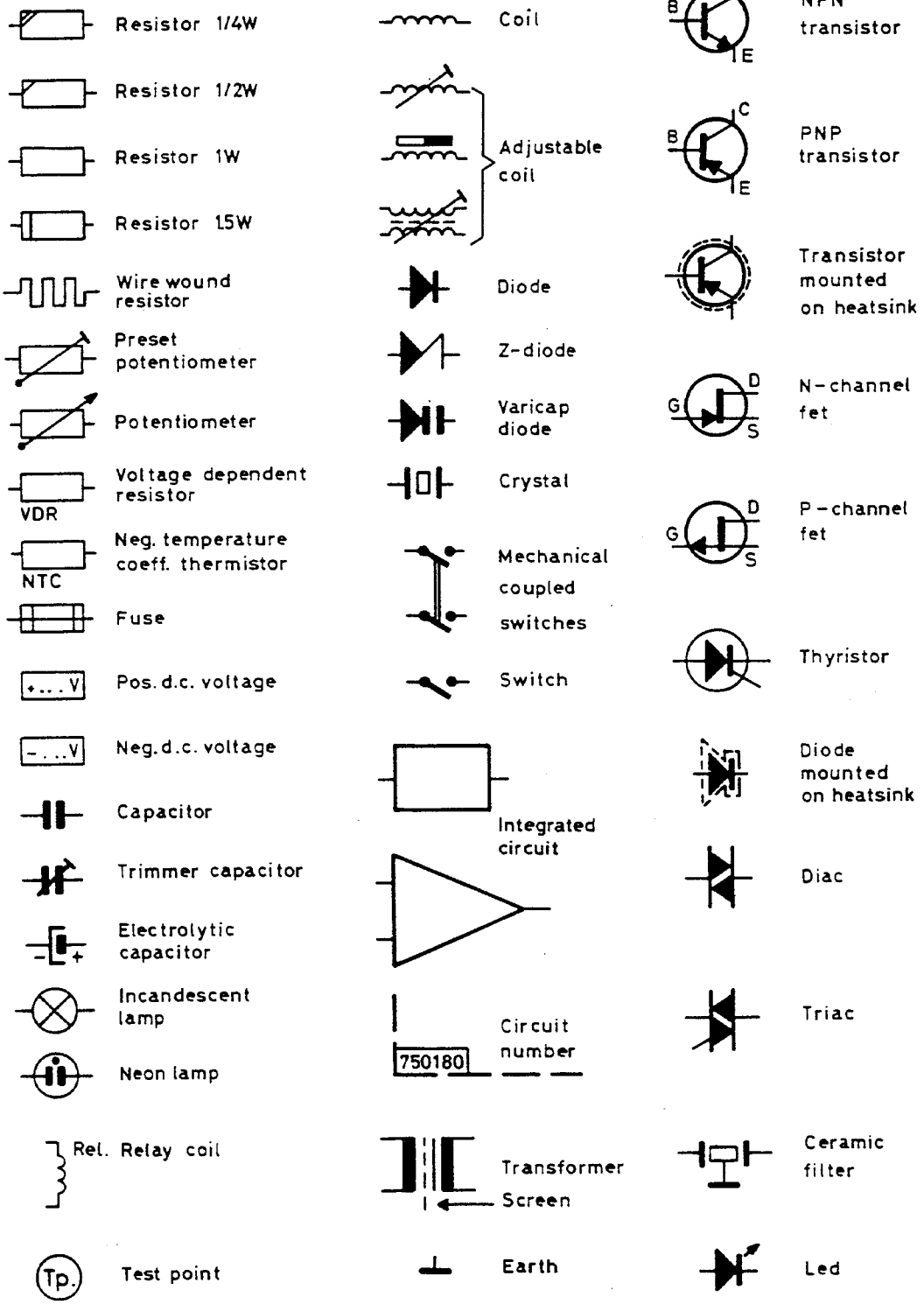
Capacitor values in pF or µF

Examples: 2.7 = 2.7 pF

2K7 = 2.7 kpF = 2700 pF

4M7 = 4.7 µF

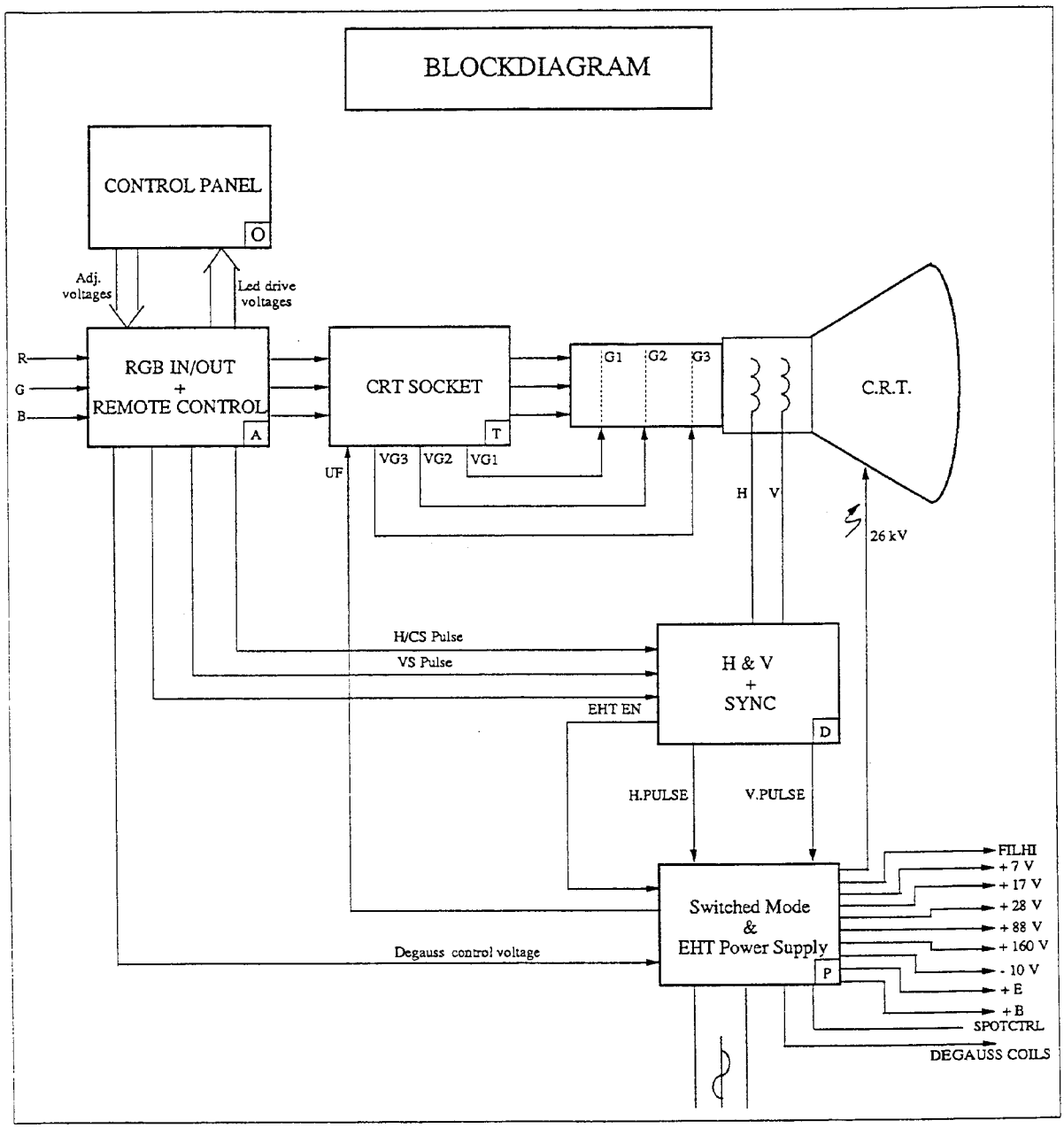
0.1µF = 100K = 100kpF



BLOCKDIAGRAM DESCRIPTION

Introduction

This chapter contains functional descriptions keyed to the overall simplified blockdiagram. Schematics are located in this chapter. Each board is drawn as a rectangular with the board identification in the right-bottom corner. Detailed schematics and descriptions can be found further in this manual.



Switched Mode and EHT Power Supply board P.

The switched mode power supply circuit and the EHT circuit are established at the same board.

- Switched mode power supply circuit.

The mains voltage arrives at board P where it will be filtered and rectified. 120 Vac or 220 Vac operation is

selectable on board [P] . Also the degauss circuit is provided. The [P] board delivers all dc supply voltages for the display with overload and overvoltage protection: filament voltage needed for the picture tube, + 7 Vdc, + 17 Vdc, + 28 Vdc, + 88 Vdc, + 160 Vdc, - 10 Vdc, + E (EHT circuit supply voltage), + B.

- EHT circuit

The EHT delivers the anode voltage to the picture tube while the focus voltage UF is applied to the CRT socket of which the grid 2 (VG2) and grid 3 (VG3) voltages are derived.

RGB IN/OUTPUT AMPLIFIER and REMOTE CONTROL board [A].

The RGB in/output circuits and the remote control circuit are established on one board.

- The RGB In/Output amplifier circuits

The red, green and blue video input signals enter the display via board [A] . On this board picture and background as well as lowlights and highlights adjustments are available. Finally, an amplifier stage brings the video signal to a sufficient level for driving the picture tube via the CRT-socket.

- The Remote control circuit

The remote control circuit controls all adjustments (Degauss, Picture, Background) by first detecting eventual changes coming from the front control panel and by sending a control voltage to the appropriate board. This remote control circuit also drives the led indicators (Picture, Background, Ready) available on the front control panel.

Control panel [O].

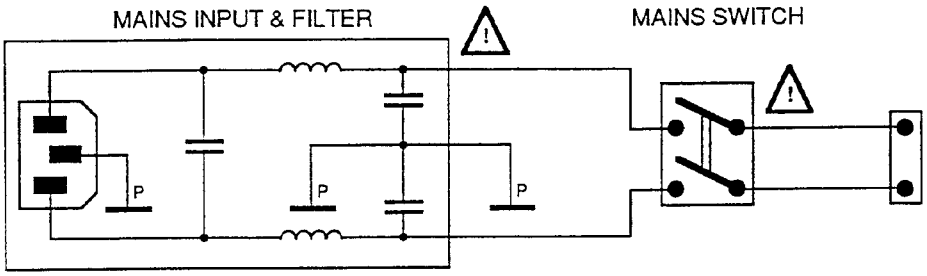
All adjustments such as Degauss, Picture and Background are passing via the Control panel before being applied to the remote control circuit. On this board the led indicators are established.

CRT socket [T].

The CRT socket delivers:
- The amplified video signals (red, green and blue) to the picture tube cathodes.
- The voltages applied at the grids of the picture tube. The VG2 and VG3 voltages are obtained at the CRT socket and derived from the focus voltage coming from board P while at grid 1 (VG1) of the picture tube the blanking signal is applied.

H & V + SYNC board [D].

The horizontal and vertical deflection as well as the sync processing are established on the same board. The horizontal deflection generates a sawtooth current of adequate amplitude through the horizontal deflection coils. The vertical deflection sends a sawtooth current through the vertical deflection coils.
The vertical and horizontal sync signal coming from the RGB IN/OUTPUT board trigger respectively the vertical and horizontal deflection circuit. Those sync pulses are used as a reference to generate other pulses such as light pulse, brightness pulse etc. which are applied to other boards.



V3132642

PRODUCT SAFETY NOTICE

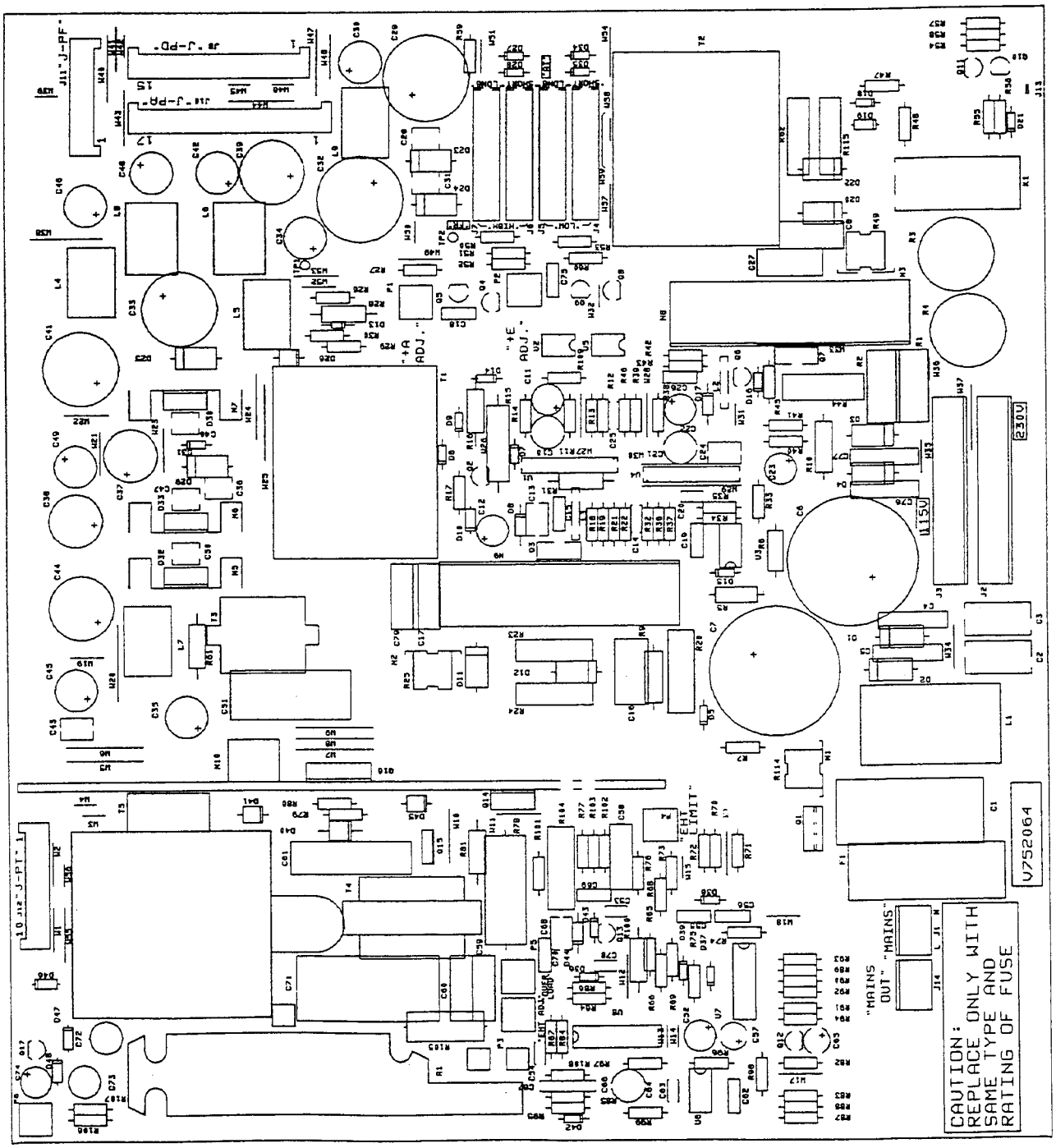
COMPONENTS MARKED WITH ⚠ OR ✻ HAVE SPECIAL CHARACTERISTICS IMPORTANT TO SAFETY BEFORE REPLACING ANY OF THESE COMPONENTS, READ CAREFULLY THE SERVICE SAFETY PRECAUTIONS.
DON'T DEGRADE THE SAFETY OF THIS SET THROUGH IMPROPER SERVICING

SWITCH PART : V324700

SWITCH CLAMP : V3247001

PUSH BUTTON : V3247002

SWITCHED MODE POWER SUPPLY BOARD



SWITCHED MODE and EHT POWER SUPPLY Board

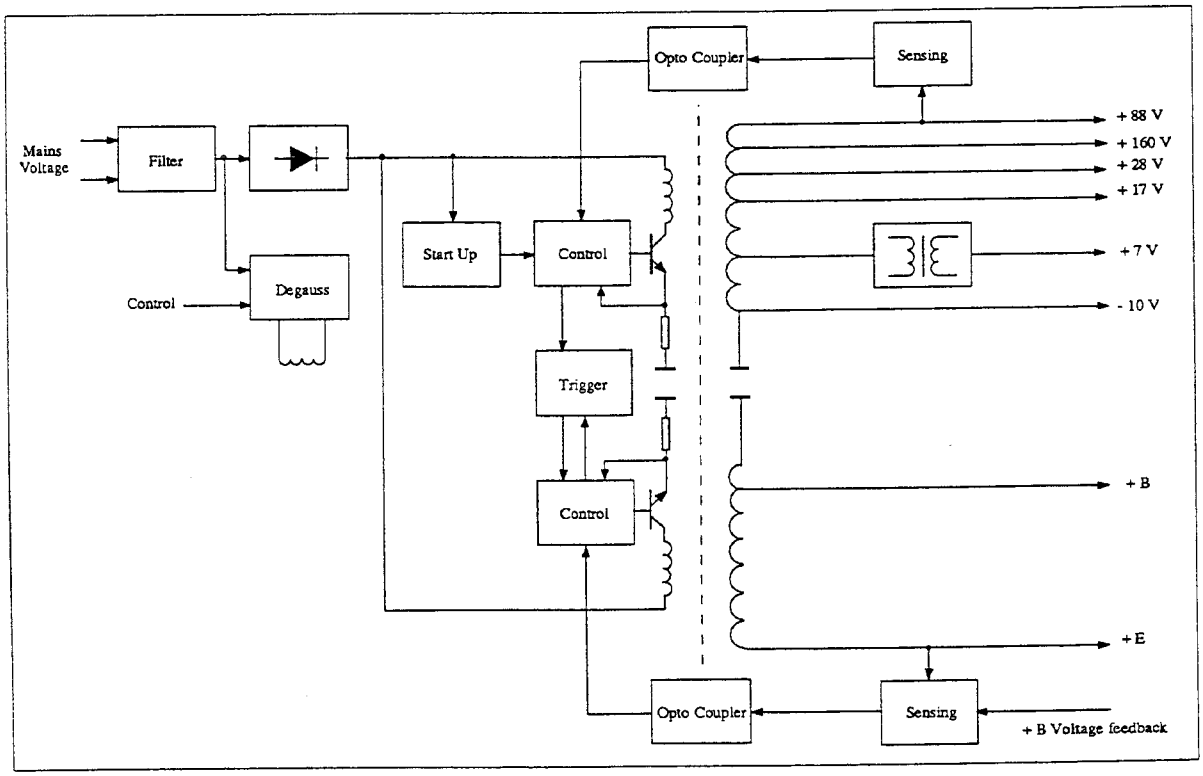
The SMPS circuit and the EHT generator are located on one board.

SMPS Circuit

General

The SMPS circuit delivers all DC supply voltages for the display, with overload and overvoltage protection. The SMPS circuit contains of:
- Asynchronous switched mode power supply 1, delivering following voltages: + 88 V, + 160 V, + 28 V, + 17 V, + 7 V, - 10 V.
- Asynchronous switched mode power supply 2, delivering the + B and + E voltage
- Degauss circuit

Block Diagram



Circuit description

The mains voltage arrives via the mains filter C1, L1, C2, and C3 at the diodes D1, D2, D3 and D4, connected as a bridge rectifier in case the display is set for 220 Vac input, or as voltage doubler in case of 120 Vac input. The rectified voltage is applied to two asynchronous switched mode power supplies via R9 and R10.

1) Asynchronous switched mode power supply 1

The main components of the first asynchronous SMPS are transformer T1, switching transistor Q3 and the control IC U1.

Low voltage supply for control and driver circuit

At start up, the supply voltage for the control and driver circuit U1 is obtained from the rectified mains voltage via a zener diode D5 and an emitter follower Q1. Afterwards the emitter follower is turned off via D6 while the supply voltage is taken over by the rectified voltage of the transformer winding pin 2-3. Peak current is limited by R16 in series with D10. The resistor R17 in series with the forward rectifier D9 prevents rise of the supply voltage to its protection value needed for control IC U1. Through D14 a start voltage is also delivered to the second switched mode power supply

pulses to U3 which causes switching on of the internal transistor Ti, shorting on its turn. The frequency of U4, now dependent of the components R37 and C21 will increase. When the maximum level is reached then a reset pulse will be given to U3 via C20 and the cycle repeats itself.

3) Degauss circuit

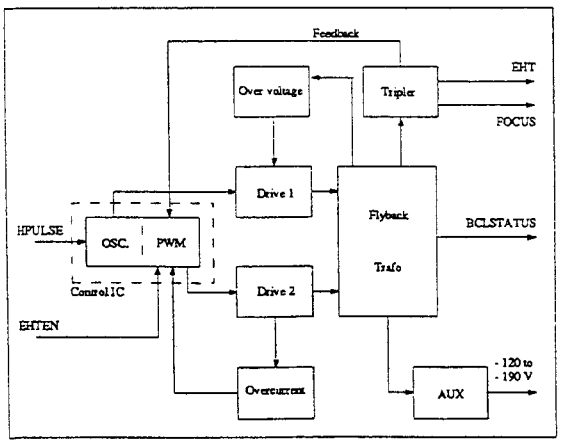
The degauss circuit is built around Q10, Q11, REL 1, two PTC's (one for 120 V mains, one for 220 V mains) and the degauss coil. Automatic degaussing is obtained when switching on the display. The mains voltage is connected to the degauss coil via the relais and the PTC. Through the current, the PTC warms up; the resistor value increases and the current decreases. After a certain time the relais switches off and the degauss cycle ends. Manual degaussing is also possible. When pushing the DEG button at the control panel, then a low level DEGAUSS signal is applied causing Q10 to turn off, Q11 switches on and the REL 1 closes, starting the degauss cycle.

EHT generator

General

The EHT generator delivers a few voltages, necessary for the picture tube:
* the EHT voltage of 26 kV.
* the FOCUS voltage applied at the focus grid.
* - 120 to -190 V for spot suppression.
Also overvoltage and overcurrent protection are available.

Block diagram

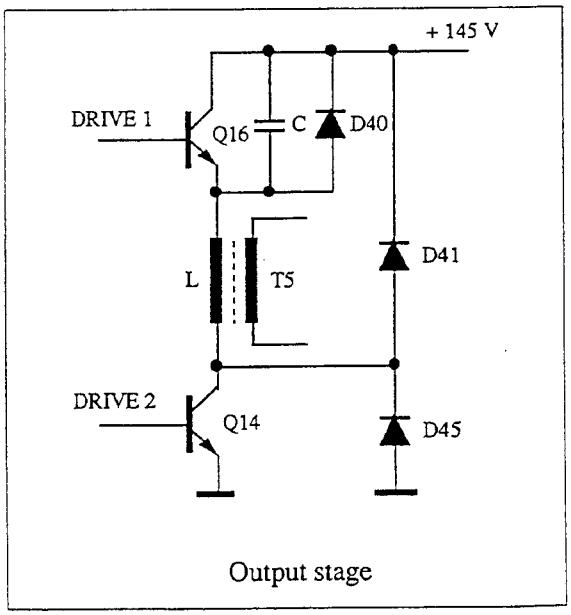


The main part of the circuit is the flyback trafo. The flyback pulses applied at the primary side are transformed and rectified by the tripler A1 to a DC voltage of 26 kV (EHT) and a focus voltage of 8 kV (FOCUS). Via an internal voltage divider of the tripler a part of the EHT voltage is fed back. The flyback generator is controlled by a control IC. This IC consists of a:
- Sawtooth oscillator which is synchronized by the H PULSE. From this oscillator the DRIVE 1 signal is derived for driving the switching transistor of the flyback generator. When an overvoltage is detected then the drive 1 signal is shut down.
- The pulse width modulator (PWM) generates the DRIVE 2 signal. The overcurrent detection is applied to the PWM, which pulse duration will be changed affecting the DRIVE 2 signal. The EHTEN information eventually switches off the DRIVE 2 signal in case no horizontal and/or vertical deflection is present. The BCLSTATUS (Beam Current Limiter STATUS), indicating the beam current level, is available at the output of the flyback trafo.

Circuit description

Flyback generator

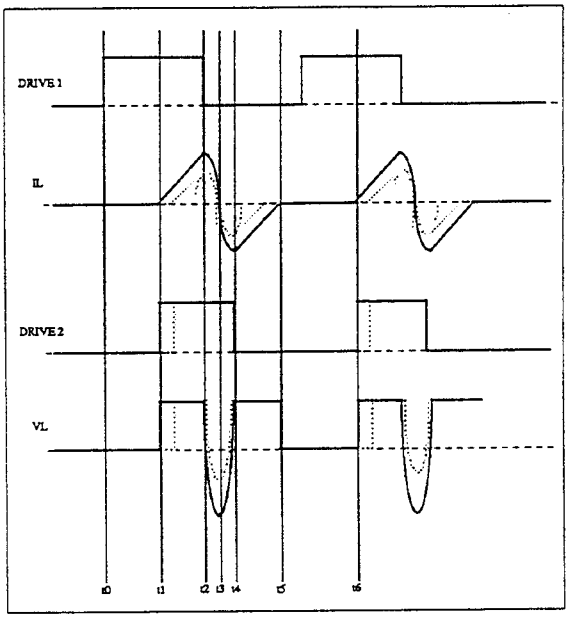
The flyback generator is shown in the simplified figure below.



Output stage

This output circuit functions as a normal flyback generator when Q14 conducts. The amount of energy stored in the transformer can be manipulated by reducing the on time of Q14, resulting in the attenuation of the flyback pulses (= EHT). The next timing diagram explains how the flyback pulse is generated and shows the relation between the conduction time of Q14 and the peak level of the flyback pulse.

MC-Service



During time t0-t1
Q16 conducts because the DRIVE 1 signal available at the base of Q16 has a high level, Q14 is blocked so no current can flow through the primary of T5 (IL=0).

During time t1-t2
Q14 will be conducting by the high level of the DRIVE 2 signal. The + 145 V supply voltage is applied completely across the primary winding L of T5 causing a linear increasing current IL.

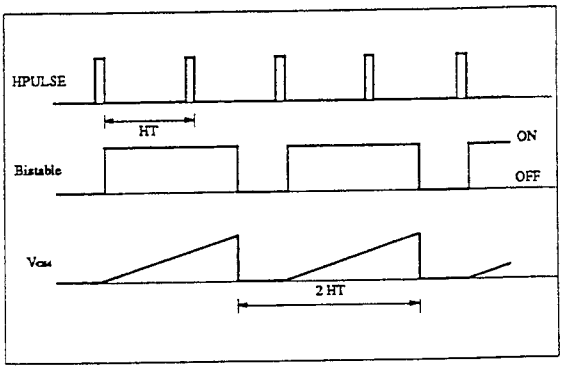
During time t2-t4
Q16 blocks. The capacitor C together with L form a resonant circuit, producing the flyback pulse.

During time t4-t5
At the moment the voltage across the coil tends to get higher than 145 V then D40 conducts. So the current IL will decrease linear to zero.

During time t5-t6
Q16 and Q14 are still blocked. The current IL is equal to zero till a new cycle repeats.

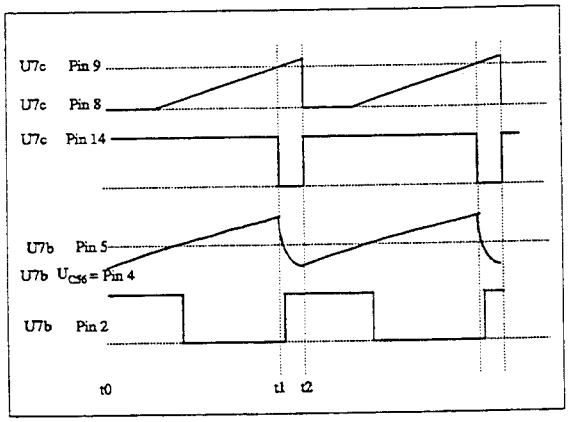
Synchronous sawtooth oscillator

The control IC U8 (TL494) has an internal sawtooth oscillator with a fixed frequency determined by R99 and C64. To obtain this synchronization with the horizontal pulse a timer IC U6 is added to the circuit, functioning as a bistable multivibrator. The horizontal pulse is applied via the voltage divider R87 and R88 at pin 6 of U6. When the voltage reaches a level equal to 2/3 of the supply voltage, then the bistable multivibrator is set in ON position. The internal transistor conducts, pulling pin 7 of U6 to ground. Now the sawtooth oscillator of U8 is started, charging C64. When the voltage built up across C64 reaches 3 V, C64 discharges via an internal network. This trailing edge is fed back via C63 to pin 2, of U6 setting the bistable multivibrator in OFF position. By chosing the correct components (C64 and R99) a situation is created so that the oscillator frequency is half of the horizontal frequency (see figure below).



DRIVE 1

The DRIVE 1 is obtained from the internal sawtooth generator of U8 and applied to the switching transistor Q16 of the flyback generator via U7c, b. The timing between both drive signals is important and occurred by creating a sawtooth (see timing diagram).

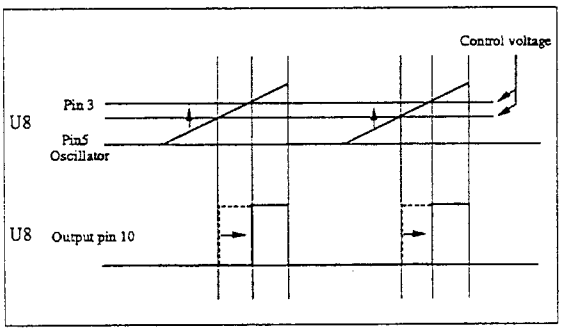


The voltage across C64 is applied at pin 8 of U7, while the voltage at pin 9 is fixed. When the output of U7c has a high voltage level (during time t0-t1) then charging of C56 is possible. The charging current is determined by R72. When pin 14 of U7c becomes low (during time t1-t2) then C56 discharges via R74. The sawtooth across C56 is AC coupled to pin 4 of U7b via capacitor C55. At the non inverting input a fixed voltage is available so that a square wave is formed at the output of U7b driving the transistor Q15. Through a driver trafo T4 the amplified square wave is applied

to transistor Q16. The DRIVE 1 signal available on pin 2 of U7b is inhibited (high) when pin 5 of U7b is pulled to a higher DC level. This can be done via D38 when an overvoltage is detected (see overvoltage protection).

Pulse width modulator and DRIVE 2

The pulse width modulator of U8 (TL494) is in fact a comparator. At the first input (pin 5) a sawtooth signal coming from the internal sawtooth oscillator is applied while at the other input (pin 3) a control voltage is available coming from the internal error amplifiers A & B (see timing diagram).



The voltage at pin 4 allows additional dominant pulse width control. This control facility is used to obtain a soft start and for EHT-ENable (see protections). U8 contains two output drivers which are connected in parallel in this application, ensuring the driving of Q14 as follow:
- During the conduction time of the output drivers the base current is provided via the + 4 supply voltage through pin 8-11 and 9-10 via D43-D44 into the base of Q14. In this state Q13 is blocked. The available voltage (5V1) across the zener D44 charges C70.
- During the blocked position of the output drivers. Q13 conducts while D43 is blocked. The cathode of D44 is applied to ground while the voltage across C70 causes a negative voltage at the base of Q14, blocking this transistor.

EHT stabilization

U8 has two internal error amplifiers. Amplifier A takes care of the voltage stabilization, while amplifier B of the overcurrent protection. Between both error amplifier outputs an OR function is obtained: the highest output voltage is used as control voltage for driving the pulse width modulator. In normal operation output A will be higher than output B. A part of the EHT voltage is fed back to pin 1 of U8 via P3, R64 and filter R67, C54. There it will be compared with a reference voltage available on pin 2. A decreasing EHT voltage will cause a decreasing control voltage at pin 3, resulting in a increased Pulse duration of the DRIVE 2 signal. The EHT voltage will increase and so a stabilization is obtained.

- 120 to - 190 Volt supply

The - 120 to - 190 volt is necessary:
- as supply voltage for the blanking amplifier on the RGB IN/OUTPUT board.;
- to drive the picture tube in cut off when switching off (spot suppression).

This negative voltage is obtained by negative rectification of the switching pulses available on the collector of Q14.

Protections

1. EHT ENable and soft start

- Soft start

During start up pin 4 of TL494 has a high voltage level because C65 is not charged. Pin 5 of the PWM has a voltage level of + 5 V causing DRIVE 2 pulses at the output pin 9 of minimum duration. Via R95 charging of C65 is possible. Pin 4 slowly becomes low and the duration of the drive pulses increases to normal level.
- EHT ENable

The EHT ENable signal arriving at pin 11 of connector PD from the H & V + SYNC board is applied via R92 to the inverting input of U7d. When no horizontal and/or vertical deflection is available then the EHT EN becomes low causing saturation of Q12 via U7d. C65 discharges so that pin 4 of U8 becomes high and the PWM generates pulses of minimum duration. When Q12 is blocked then the soft start cycle repeats.

2. H Pulses

When no H Pulses are available then the control IC U8 does not operate, so no EHT voltage is generated.

3. Overvoltage protection

The EHT voltage may never exceed 29 kV for safety precautions. The voltage across the extra winding is a measure for the EHT voltage level. First it will be rectified by D36 and applied via R65 to pin 7 of the comparator U7a. The voltage at the inverting input pin 6 is adjustable with P4. When the voltage at pin 7 is higher then the set voltage at pin 6 then the output becomes high. This high voltage level passes via D38 to the non inverting input of U7b. So the DRIVE 1 signal becomes inhibited. The EHT generator does not operate. This condition is held by D37 as the power supply remains present.

MC-Service

4. Overcurrent protection

The voltage available at pin 16 of U8 depending of the current through the flyback generator is compared with overload voltage formed by R96 and P5. This overload voltage is adjustable with P5. When an overload is detected then the output of amplifier B increases, resulting in a decreased pulse duration of DRIVE 2 and the conduction time of Q14 decreases together with the current through this transistor.

5. BCL (Beam Current Limiter)-status

The secondary winding which provides the beam current is connected with ground via resistor R106 and P6. In proportion to the beam current a negative voltage, is built up over these resistors via filter R107-C74 this voltage is applied to the emitter of Q17. When the emitter voltage becomes lower than - 0.7 V then Q17 conducts causing a low voltage level at the collector of Q17. This info is applied to the RGB board as Beam Current Limiter.

PARTS LIST OF THE SWITCHED MODE POWER SUPPLY & EHT
Order number of a complete unit : V5629431

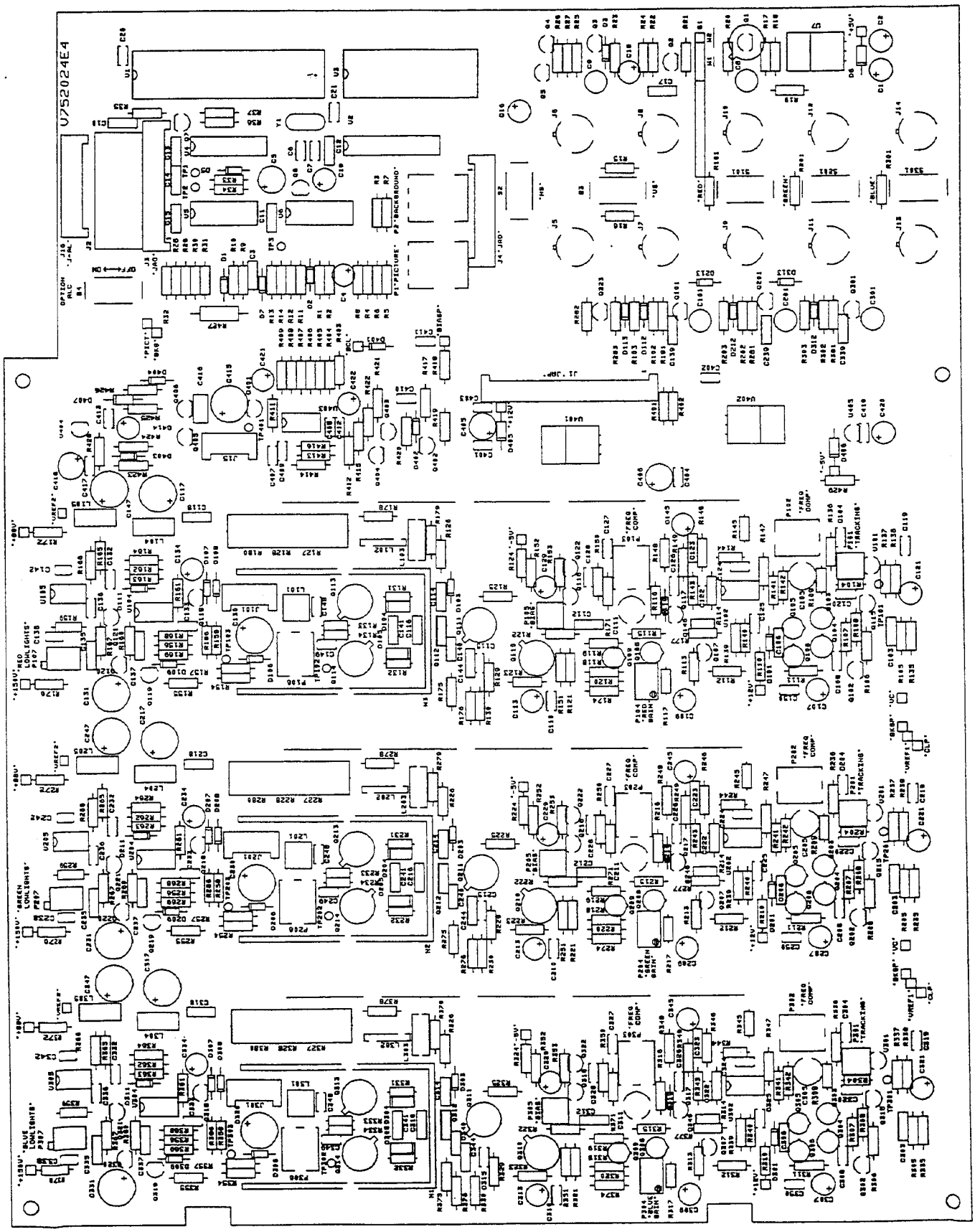
Order number	Description					Item
V100116	R	MF	V	22E	J	R118,R119,R120,R121
C1011169	R	CFF		22E	J	R71
C1011947	R	CFF		E47	K	R122
V101216	R	MF		22E	J	R109
V101218	R	MF		33E	J	R80
V101219	R	MF		39E	J	R43
V101220	R	MF		47E	J	R123
V101221	R	MF		56E	J	R47
V101224	R	MF		100E	J	R102,R106,R107,R18 ,R27 ,R53 , R74
V101226	R	MF		150E	J	R56
V101227	R	MF		180E	J	R101
V101232	R	MF		470E	J	R21 ,R22 ,R33 ,R45 ,R46
V101234	R	MF		680E	J	R57
V101236	R	MF		1K	J	R103,R19 ,R42 ,R67
V101237	R	MF		1K2	J	R14 ,R40
V101240	R	MF		2K2	J	R116,R117,R55 ,R76
V101241	R	MF		2K7	J	R84
V101243	R	MF		3K9	J	R52 ,R58 ,R68
V101244	R	MF		4K7	J	R69 ,R89 ,R90
V101246	R	MF		6K8	J	R125
V101247	R	MF		8K2	J	R70
V101248	R	MF		10K	J	R54 ,R86 ,R88
V101249	R	MF		12K	J	R38
V101250	R	MF		15K	J	R11 ,R13 ,R77 ,R83
V101252	R	MF		22K	J	R31 ,R82 ,R87 ,R92
V101254	R	MF		33K	J	R66
V101255	R	MF		39K	J	R12 ,R39
V101256	R	MF		47K	J	R26 ,R91 ,R93 ,R94
V1012561	R	MF		43K	J	R64
V101257	R	MF		56K	J	R72
V101258	R	MF		68K	J	R32
V101259	R	MF		82K	J	R85 ,R95
V101260	R	MF		100K	J	R29 ,R34 ,R35 ,R73 ,R96 ,R98
V101264	R	MF		220K	J	R75
V101265	R	MF		270K	J	R65
V101266	R	MF		330K	J	R7
V101268	R	MF		470K	J	R97
V1018998	R	CFF		E1	K	R10 ,R9
V102024	R	CC		100E	K	R124
V102060	R	CC		100K	K	R5 ,R6
V102316	R	MF		22E	J	R15 ,R16
V102319	R	MF		39E	J	R48
V1026117	R	MF		13K	F	R37
V1026576	R	MF		3K92	F	R36
V1026706	R	MF		5K36	F	R99
V1026816	R	MF		6K98	F	R30
V102904	R	MF		2E2	J	R79
V102916	R	MF		22E	J	R17 ,R41 ,R61
V102919	R	MF		39E	J	R100
V102942	R	MF		3K3	J	R81
V102949	R	MF		12K	J	R28
V102956	R	MF		47K	J	R50
V102960	R	MF		100K	J	R51
V103347	R	MO		8K2	J	R78
V1035042	R	WW	H	E22	K	R104,R20 ,R44

Order number	Description	Item
V104254	R WW V 15K K	R114
V104345	R WW V 2K7 K	R25 ,R49
V104358	R WW V 33K K	R115,R23 ,R24 ,R62
C1046781	R HV 10M J	R105
V105011	R NTC 10E	R1
V105016	R NTC 4E7	R2
C105209	R PTC 2	R4
C105210	R PTC 1	R3
V106727	R T CEMH 2K K	P1 ,P2
V106732	R T CEMH 50K K	P4
V107006	R T CEMH 1K M	P5
V107007	R T CEMH 2K M	P6
V107010	R T CEMH 20K M	P3
C1113719	CELPR 1000M M7 50	C33
C1113999	CELPR 47M M 160	C83
V111412	CELPR 4M7 M5 250	C30 ,C34
V1114689	CELPR 470M M 16	C45
V111470	CELPR 1000M M5 16	C48 ,C49
V1114709	CELPR 1000M M5 16	C44
V111471	CELPR 1000M M7 25	C41
V111474	CELPR 1M M5 400	C72 ,C73
V111477	CELPR 100M M5 25	C12 ,C23 ,C74
V1114795	CELPR 470M M5 25	C35 ,C42
V1114809	CELPR 220M M 35	C46
V111484	CELPR 100M M5 100	C37 ,C38 ,C39
V111485	CELPR 100M M7 200	C29 ,C32
V1115115	CELPR 47M M5 25	C11 ,C22 ,C52
V1115315	CELPR 10M M5 50	C53 ,C57 ,C65
V1116431	CELRA 470M M 200	C6 ,C7
C111760	CPPMEPO 1K J 2000	C61
V1120902	CCE DI100P K 2000	C28 ,C31
V112236	CNP0 MI 33P G5 63	C20 ,C63
C112743	CCE MI 2K2 K5 63	C14 ,C25
C112747	CCE MI 4K7 K5 63	C18 ,C75
V112762	CCE MI 4K7 U5 63	C68
C112763	CCE MI 10K U5 63	C62
V112817	CCE DI220P M 400	C36 ,C40 ,C47 ,C50
V112839	CCE DI 15K S 500	C4 ,C5 ,C76 ,C77
V114024	CPOMEPO 3K3 K 250	C60
V114036	CPOMEPO 33K K 250	C59
V1140422	CPOMEPO100K K 100	C58
V114080	CPOMEPO 10K K5 63	C19 ,C84
V114081	CPOMEPO 15K K5 63	C15 ,C26 ,C69
V114084	CPOMEPO 47K K5 63	C78
V114088	CPOMEP0100K K5 50	C55
V114092	CPOMEPO470K K5 50	C43
V114094	CPOMEP0680K M5 50	C13 ,C70
V114098	CPOMEPO 2M2 M5 50	C24
C114451	CPO FF 15K K 400	C8 ,C81
V114476	CPO FF 6K8 K 630	C16
V114480	CPO PO 1K M5 100	C66
V114481	CPO PO 1K5 M5 100	C56
V114486	CPO PO 6K8 M5 100	C82
C1147169	CPOSAPO 1M MAC250	C1
C114722	CCESADI 2K2 MAC400	C2 ,C3
V115002	CPPMEP0 22K J 2000	C71
V1150722	CPPMEPO470K K 250	C51
V1151212	CPC P0470P M 630	C17 ,C27 ,C79 ,C80
V1151602	CPP PO820P H5 100	C10 ,C21

Order number	Description	Item
V1151672	CPP PO 4K7 H5 63	C64
V115182	CPC PO330P K5 100	C54
V1314073	SMCTRA BC 547 C	Q10 ,Q11 ,Q17
V1314133	SMCTRA BC 557 C	Q12 ,Q4 ,Q5 ,Q8 ,Q9
V131471	SMCTRA BF 458	Q15
V1316211	SMCDIO 1N4148	D36 ,D37 ,D38 ,D39 ,D42 ,D48 , D51
V131624	SMCDIO BAX 18	D14 ,D16 ,D18 ,D21 ,D31 ,D43 , D6 ,D7 ,D9
V131658	SMCDIOLED 3.0MM YEL	D50
V131667	SMCDIOLED 3.0MM GRE	D49
V131692	SMCOPTCOU CNX 82 A	U2 ,U5
V1317205	SMCDIOREF 1N823/6V2	D13
V131741	SMCDIOZEN 0.5W C 13	D5
V131756	SMCDIOZEN 0.5W C7V5	D15
C131782	SMCDIOZEN 1.3W C5V1	D17 ,D44 ,D8
C131902	SMCDIOREC BY 255	D1 ,D2 ,D3 ,D4
V1319033	SMCDIOREC BYD 33 J	D10 ,D19
V1319035	SMCDIOREC BYD 33 M	D46 ,D47
V131909	SMCDIOREC PBYR 1045	D32 ,D33
V131912	SMCDIOREC BYV95 C	D26
V131914	SMCDIOREC BYW96 E	D12 ,D22
V131917	SMCDIOREC BY 228	D40
V1319184	SMCDIOREC BY229- 400	D30
V131921	SMCDIOREC BY 299	D11 ,D20 ,D23 ,D24 ,D25 ,D29
V131954	SMCDIOREC BYV27-200	D41 ,D45
C132071	TRI BG2097-641- 502	A1
V132501	SMCTRA BC 327-25	Q13
V132512	SMCTRAPOW BF 587	Q1
V1325601	SMCTRAPOW BUV 27 AF	Q14
C132562	SMCTRA BC 639	Q2 ,Q6
V132573	SMCTRA BU 903	Q16
V1325791	SMCTRAPOW BD 651 F	Q18
V132592	SMCTRAPOW BUT 12 A	Q3 ,Q7
V132745	SMCICLSM TEA1039	U1 ,U4
V133026	SMCTRA COOLER TO 18	
C133052	SMCTRA COOLER TO220	
C133054	SMCTRA CLIP SOT93	
C133055	SMCTRA ISO PL SOT93	
V134005	SMCICLVOL LM 339	U7
V134109	SMCICL NE 555 N8	U3
V1341091	SMCICCMOS TLC555	U6
C137296	SMCICL TL 494 CN	U8
V306196	COIL BRIDGE 140UH	L4 ,L5 ,L7 ,L9
V306222	COIL 80.0MH 2.0A	L6 ,L8
V306228	COIL 2X 29.0MH 4.0A	L1
V306728	TRF AT4043/ 03	T4
V306729	TRF SMPS AT3010/110	T1 ,T2
V311061	CON LED TE-SE 3 P 1	
C313224	RRWW V HOLDER H25	
V3133024	CON F JUMP 3.96 P 4	
C313454	CON MOB .187 .5 P 1	J13
V313607	CON MOB TE .156 P 3	J1 ,J14
V3136081	CON MOB TE .156 P11	J2 ,J3
V3137090	CON MOB TE MTIS P 9	J11
V3137100	CON MOB TE MTIS P10	J12
V3137150	CON MOB TE MTIS P15	J8
V3137170	CON MOB TE MTIS P17	J10
C314116	FUSE 5X20 2.000A T	F1

Order number	Description	Item
V314504	FUSE HOLD UNIVERSEL	
V324348	RELAY 285E 12V 2XU	K1
V342168	WIRE AWG24 UL1007 W	
V348000	CABLE TIE B2.5L 98	
V348045	CABLE TIE B3.4L280	
C348070	KABELCLIPS D9.53	
V3481014	JUMPER 0.6 5.08 MM	C67
V3481024	JUMPER 0.6 7.62 MM	W13 ,W14 ,W15 ,W26 ,W3 ,W31 , W32 ,W36 ,W39 ,W4 ,W42 ,W45 , W46 ,W50 ,W56 ,W62 ,W64 ,W71
V3481034	JUMPER 0.6 10.16 MM	W18 ,W19 ,W35 ,W52
V3481044	JUMPER 0.6 12.70 MM	R108,W1 ,W11 ,W12 ,W16 , W17 ,W2 ,W21 ,W22 ,W23 ,W27 , W28 ,W34 ,W41 ,W48 ,W49 ,W53 , W57
V3481054	JUMPER 0.6 15.24 MM	W10 ,W43 ,W54 ,W55 ,W63
V3481064	JUMPER 0.6 17.78 MM	W24 ,W37 ,W40 ,W44 ,W47
V3481074	JUMPER 0.6 20.32 MM	W20 ,W25 ,W38 ,W5 ,W6 ,W60 , W7 ,W8 ,W9
V3481088	JUMPER ISO 22.86 MM	W33
V3481097	JUMPER ISO 25.00 MM	W29 ,W30
C348200	SLEEVE D1.5 10MM	
C3482005	SLEEVE D1.5 5MM	
C348202	SLEEVE D1.5 15MM	
V3493521	WIRE UN FOCUS 7651	
V362199	SMP+ M 3 X 8 COMBI	
V3636025	SMP+C 2.9X 9.5D7981	
V366940	NUT M3 PC BOARDS	
V367502	WASHER LA 3.2 D6798	
V601055	HEATSINK SMPS S 76	
V601070	HEATSINK EHT/SMPS CD	
V671010	TRF EHT ICD451B/CD6	T5
V716543	PCB TESTPOINT 04	TP1 ,TP2 ,TP3 ,TP4
V750443	SMCTRA CLIP TO220	
V752073	PCB SMPS/EHT	
V7730541	CHOKE NO S 5.0UH	L2 ,L3
V775323	TRF DRIV ICDX51	T3

RGB IN/OUT AMPLIFIER & REMOTE CONTROL BOARD



Description of the RGB IN/OUT AMPLIFIER and REMOTE CONTROL board.

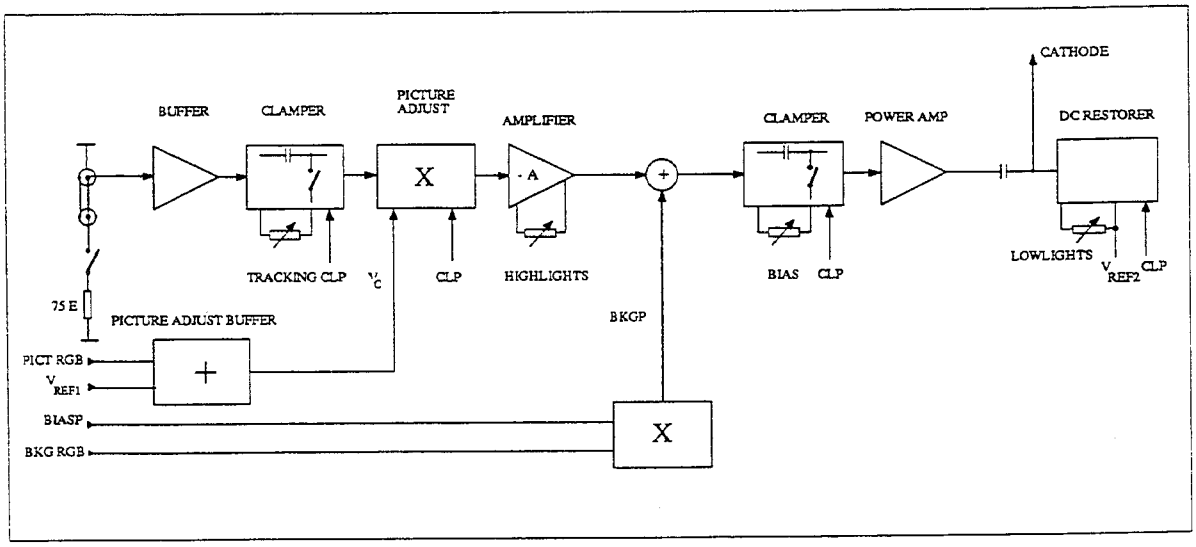
The RGB IN/OUTPUT circuits and the REMOTE CONTROL as well as the SYNC INPUT AMPLIFIERS are all available on one board.

RGB IN/OUT AMPLIFIER circuits

General

The R, G and B in/output circuits are identical so only the red in/output circuit is described.

Block Diagram



The video signal is applied to the RGB INPUT/OUTPUT circuit via the BNC connector. This input can be terminated in 75 Ω by means of the termination switch. The video signal passes a buffer and is clamped during the clamp pulse (CLP) on an adjustable DC voltage. So a same operating point will be obtained in order to improve the tracking between the three colours. The clamped video signal is amplified or attenuated by the picture adjust circuit, gain controlled by the contrast voltage Vc. The contrast voltage Vc is the output of a summing stage which inputs are the picture adjust voltage (PICT RGB) coming from the µC and a reference voltage. Then the video signal is amplified and inverted. This amplifier stage contains the manual highlights adjustment. Now the adjustable BacK-GroundPulse (BKGP) is added to the video signal. The backgroundpulse is obtained by multiplying the BIASPulse (BIASP) and the background voltage (BKG RGB) coming from the µC. The video signal is clamped on an adjustable DC voltage which provides the correct biasing of the following output stage (Power Amplifier). The output signal of the power amplifier is AC coupled with the CRT cathode. The DC restorer takes care of the correct DC setting of the cathode and the lowlights adjustment.

Circuit description

Video input, buffer

The video signal enters the board via the BNC connector. This input can be terminated in 75 Ω by means of the termination switch S101. This signal is buffered by Q101 causing a high input impedance in non terminated position. The emitter resistor R105 terminates the PCB line connecting the input to the video amplifier.

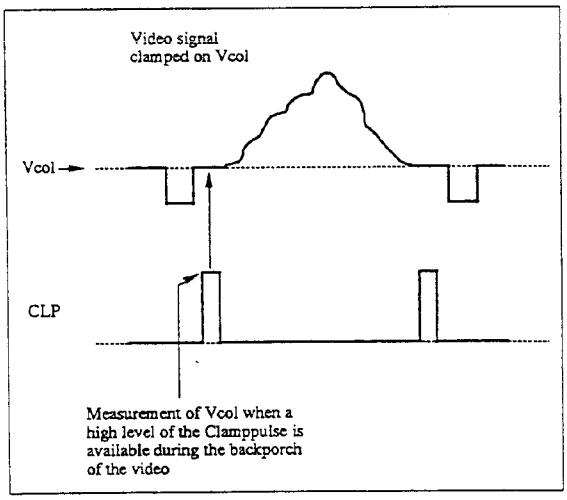
Clamper

The available video signal on the emitter of Q101 will be clamped on an adjustable DC voltage. This clamper is built around C103 and Q115 and controlled by the CLampPulse (CLP). At the moment the clamppulse arrives via C119 and R137 then Q115 conducts caus-

ing clamping of the video signal which is available on the collector of Q115. The clampvoltage can be adjusted with P101, affecting the current through transistor Q103 of the video amplifier via the buffer Q102. This adjustment sets equal operating points for the 3 channels, improving the tracking between the three colours.

Picture adjustment

The picture adjust circuit is built around Q104, Q105, a correction network U102a, b and Q117. Picture adjustment is obtained by changing the gain of the amplifier. Therefor more or less current must flow through Q105. This is controlled by and proportional to the contrast voltage Vc. To make it a linear law, the collector voltage of Q106 must be constant. This is realised with a correction network (U102, Q117). This network takes a sample of the collector voltage during the backporch of the video signal. This is controlled by the CLampPulse.



When a clamppulse arrives at the gate of Q117 via R149, C126 then Q117 conducts. The collector voltage of Q106, which is available via the buffer U102a, at the drain of Q117 charges the capacitor C123. The voltage across C123, determined by the collector voltage of Q106, is applied to the inverting input of U102b via R144 to be compared to a reference voltage available at the non inverting input. The output of U102b (pin 7) causes eventual correction of the collector voltage of Q106 by changing the base voltage of Q105 via R141.

Amplifier and highlights adjustment

The clamped video signal is applied at the base of Q108 via buffer Q107. Q108 gives extra gain and a correct polarity to the video signal. The BacKGroundPulse (BKGP) is added via C109 and R117 to the amplified video signal which is available on the collector of Q108. With P104 highlight adjustment is possible for a correct white balance. Frequency compensation is possible with C111 and P103. The amplified signal passes the buffer Q109.

Clamper

Dependent on the highlights setting an in DC variable signal is available at R119. This signal is clamped by C112 and Q116 to a voltage, adjustable with P105, providing correct biasing of the output stage via the buffer Q110.

Output stage

The output stage is built around Q111, Q112, Q113 and Q114. The cascodeswitching of Q111 and Q112 is followed by a complementary emitterfollower (Q113 and Q114) which ensures a correct separation between the picture tube capacity and the cascode amplifier. The amplification factor is about 30. The RL networks (R178, L102/R179, L103) in the collector circuit of Q112 compensate the low frequency distortion resulting in visual streaking.

DC restorer

The output stage is supplied with + 90 V in order to limit the dissipation. This voltage is too low for direct DC setting of the cathode. Therefore a DC restorer is applied adding a DC voltage to the amplified video signal. The main part of this DC restorer consists of the current source Q118. The cathode voltage as well as its stability are respectively determined by the current and stability of the current source. The current can be set by P107. Stability is obtained by the feedback loop built around U105. U105 compares the voltage across the current sensing resistor R164 applied at pin 3 of U105 to the reference voltage applied at pin 2. Its collector voltage, also determined by R157, R158 and its outputresistor R186, is limited to 0.35 V with the schottky diodes D106, D107 to avoid overdriving and disruption of the adjusting loop. This collector voltage is buffered by U104b and applied at the drain of the FET Q121 which is driven by the CLampPulse (CLP). During the clamppulse Q121 conducts and the capacitor C135 charges to a voltage level determined by the collector voltage of Q118. The voltage across C135 is applied at pin 3 of U104a, where it will be integrated. According to this voltage Q120 will be more or less conductive and the drain voltage will be applied to the CRT cathode via emitter follower Q119 and R154 and R155.

Contrast buffer

The picture adjustment circuit requires a contrast voltage V_c which is obtained by adding a reference voltage

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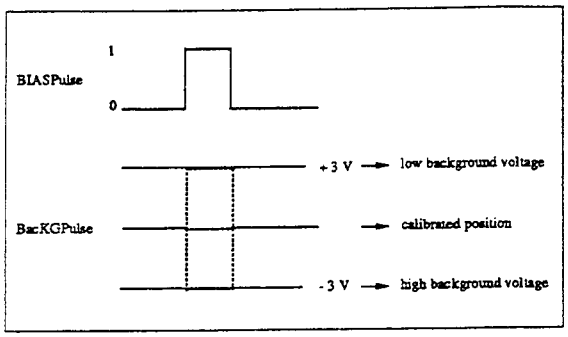
(2.5 V) to the picture adjustment voltage PICT RGB coming from the µP. The picture adjustment voltage is variable between 0.3 and 5.2 V and is applied via R406 to the summing stage U403. The reference voltage is taped from U405 and applied via R405 to U403. The summation of both voltages is available at the output of U403 (pin 7) driving the transistor Q401, which emitter voltage is used as contrast voltage V_C. In case to much current is drawn from the CRT, then a low is available at the Beam Current Limit (BCL), pulling down U403 pin 5 via D401, R404. So contrast is decreased to the safe limit.



Background buffer

Its purpose is to obtain an adjustable bipolar BacK-GroundPulse (BKGP) which is equal to zero in calibrated position. The background buffer is built around U403, Q402 ... Q404. The unipolar background voltage coming from the µP is applied via R414 to the inverting amplifier U403. At the output of the inverting amplifier U403 pin 1, a DC voltage is available which can vary between - 3 V and + 3 V. This voltage is shorted via R422 by Q403 at the moment the BIASP arrives.

Blanking amplifier

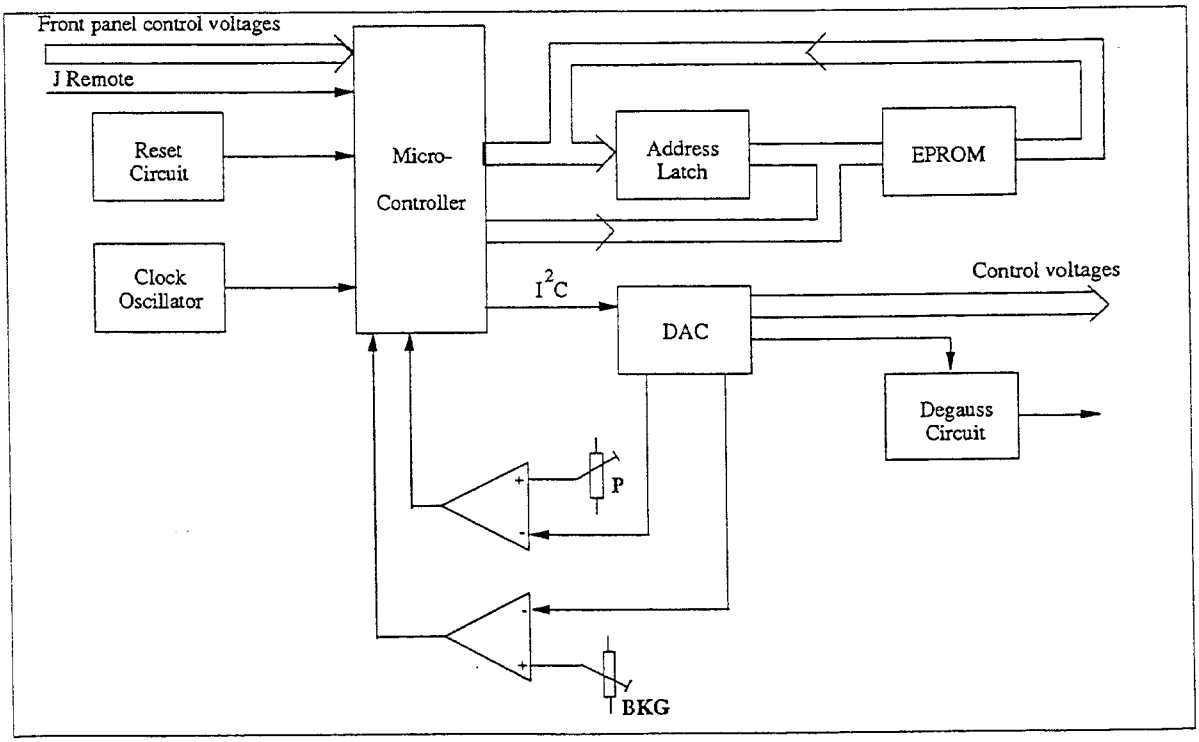
The blanking amplifier is built around Q405, Q406. The mixed blanking pulse (MB) coming from the H & V + Sync board is applied at the gate of Q405 via C413 and R424 while it is also AC coupled via C414 to the gate of Q406. The drains of the parallel coupled fets function as G1 voltage. During the active video the G1 is switched to GND via Q405 while otherwise (during blanking) G1 is coupled with - 150 V via Q406.

Remote Control circuit

General

The CD651 brightness, contrast and degauss function are controlled by a 8031 microcontroller. This controller provides an I²C interface and is remote controllable (unidirectional).

Block diagram



Circuit description

Clock oscillator

The internal circuitry of U1 together with C6, C7 and X-tal Y1 form the clock oscillator which runs at 11.059 MHz.

Microcontroller

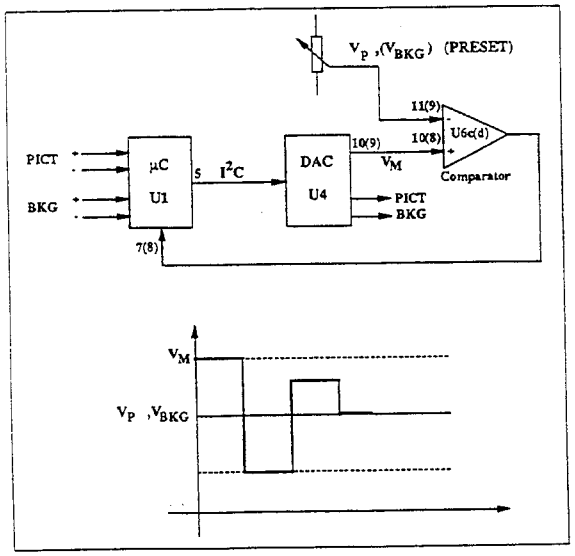
The microcontroller (U1) is a 8031 controller. The µC uses U3 as program memory (EPROM). U2 (74LS373) functions as address latch, which holds the EPROM's address during the multiplexed address/data cycle.

Reset circuit

The reset circuit consists of R13, D7, C5, R34, Q6 and C19. During start up the supply voltage at the node of R13/C5 and R34/C19 increases slowly towards its nominal value. Via R34 charging of C19 is possible. The built up voltage increases faster than the built up voltage across C5 via R13. So a positive pulse which represents the reset pulse is available at pin 9 of U1. When the voltage across C5 reaches 0.7 V, then Q6 switches on, discharging C19 very quickly. The diode across R13 ensures that C5 is discharged quickly when the power is switched off.

Picture and background preset adjustments

When switching on the display or selecting the calibrated position for picture and/or background, then a preset level is selected. The picture and background presets are based on the following principal (see next figure).



The picture preset level is determined by P1, the background preset level by P2. These presets are only active for a few minutes after the two buttons (CAL position) are pressed simultaneously on the front panel. First the µC measures the DC voltages Vp (VBKG) coming from P1 (P2) via U6c (U6d). Then first the µC sends a digital value via pin 5 to the serial data input (SDA) of the DAC. There it will be converted to an analog voltage VM which is applied via pin 10(9) of U4 to the comparator U6c(d) to be compared to Vp (VBKG) voltage. The resulting output voltage level is fed back to the microprocessor U1, indicating if modification of the digital value to the DAC U4 is necessary. When VM reaches the lock range of VP(VBKG) then the measuring step determined by U1 will be smaller till VM = VP(VBKG).

Front panel control

Control signals to and from the front panel are applied to the board via connector JAO. The 5 signals coming from the front panel (PICTURE DOWN/UP, BACKGROUND DOWN/UP, DEGAUSS) are scanned by the controller, detecting eventual changes. When a picture or background change is detected by the µC, then the DAC value is changed via the I^2C bus, manipulating the picture and background via the pins 15 and 16 of U4. The signals which are applied to the front panel are driving the picture and background leds. Those leds indicate if the CD651 is in its calibrated position.

Degauss circuit

When the degauss button on the front panel is pressed, then a low voltage level will be available at pin 8 of connector JAO which is detected by the µC. U1 changes the DAC value of U4 via the I^2C bus. This causes a high voltage level at pin 12 of U4, which triggers the monostable multivibrator built around U6a,b. The delay time (approx. 6 sec) closes the degauss relais.

Remote control

The CD651 is remote controllable via JREMOTE. The protocol is compatible with the BARCO 7X51-series.

Sync Input Amplifiers

The HS/CS signal (Horizontal Sync or Composite Sync input) is applied to the board at the BNC input J5 while the VS (Vertical Sync input) arrives at the BNC input J7. Both signals can be terminated in 75 Ω by means of the termination switch (S3). Via capacitor C8 the horizontal sync or composite sync signal is available at the base of Q1. The correct polarity of the sync applied at the base of Q2 can be selected via switch S1. With switch S2 the INT (Sync on Green) or EXTernal sync can be selected. The selected sync is available at the base of Q3 to be clamped by R23, R24, C18 and D3. At the collector of Q3 a current comparator (Q4, Q5) is applied to obtain a proper HS/CS signal at the output which will be used at the H & V Deflection + Sync board.

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PARTS LIST OF THE RGB INPUT / OUTPUT
Order number of a complete unit : V5629410

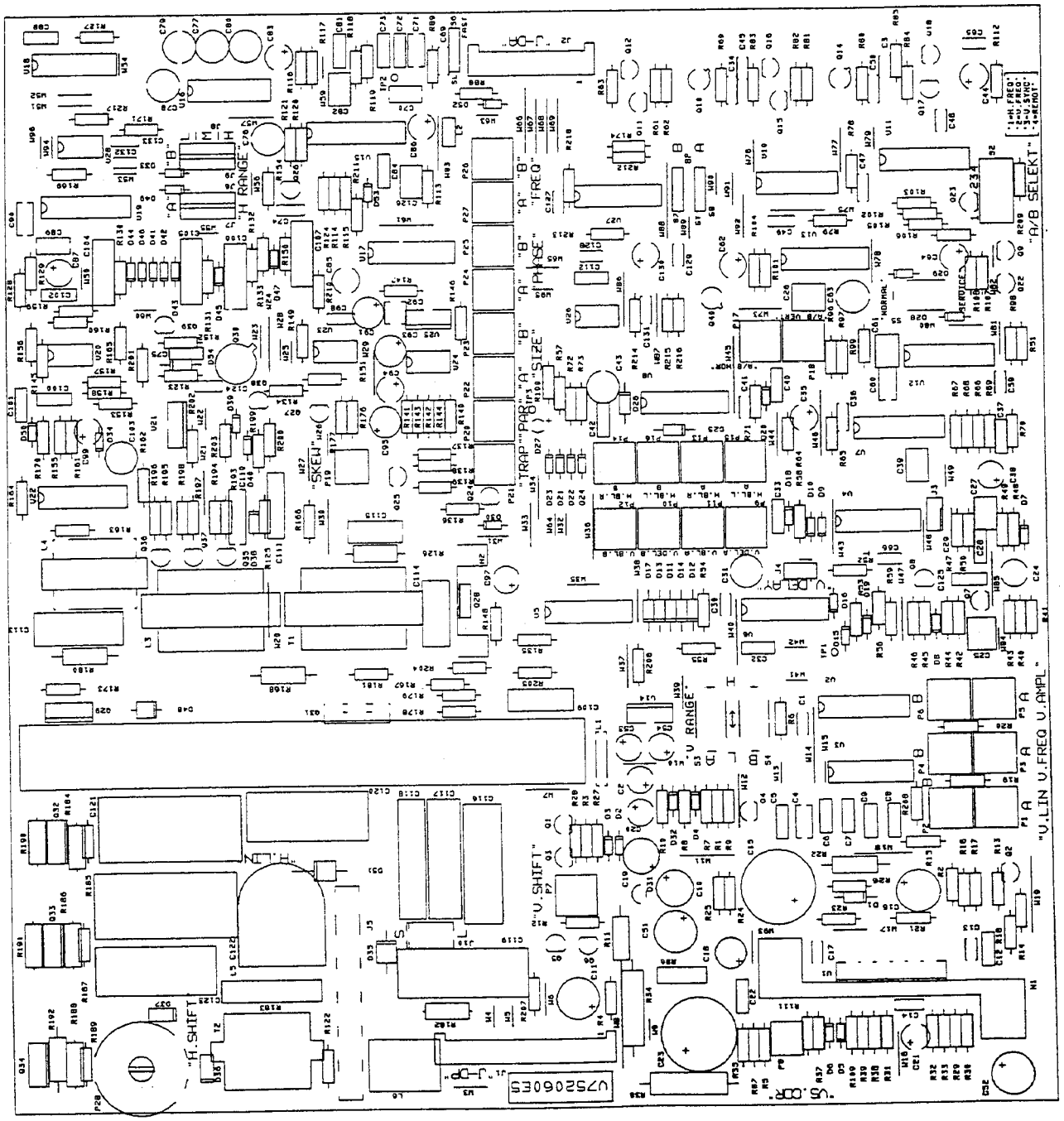
Order number	Description				Item
V1011008	R	CFF	1E	J	R401,R402
C1011049	R	CFF	2E2	J	R172,R272,R372
C1011129	R	CFF	10E	J	R146,R147,R160,R161,R246,R247, R260,R261,R346,R347,R360,R361, R411,R412
V101208	R	MF	4E7	J	R178,R278,R378
V101210	R	MF	6E8	J	R130,R230,R330
V101211	R	MF	8E2	J	R179,R279,R379
V101212	R	MF	10E	J	R114,R120,R123,R131,R132,R133, R134,R170,R174,R214,R220,R223, R231,R232,R233,R234,R270,R274, R314,R320,R323,R331,R332,R333, R334,R370,R374
V101216	R	MF	22E	J	R115,R129,R21 ,R215,R229,R315, R329
V101218	R	MF	33E	J	R142,R175,R242,R275,R342,R375, R424,R425
V101219	R	MF	39E	J	R176,R276,R376
V101220	R	MF	47E	J	R106,R108,R112,R118,R122,R206, R208,R212,R218,R222,R306,R308, R312,R318,R322,R416
V101221	R	MF	56E	J	R105
V101222	R	MF	68E	J	R116,R205,R216,R316
V101224	R	MF	100E	J	R125,R167,R181,R225,R25 ,R26 , R267,R27 ,R281,R325,R35 ,R367, R381,R428
V101226	R	MF	150E	J	R137,R150,R237,R250,R337,R350
V101228	R	MF	220E	J	R20
V101230	R	MF	330E	J	R282
V101232	R	MF	470E	J	R135,R143,R235,R243,R283,R335, R343
V101235	R	MF	820E	J	R19
V101236	R	MF	1K	J	R107,R113,R119,R12 ,R124,R126, R141,R162,R207,R213,R219,R224, R226,R24 ,R241,R262,R307,R313, R319,R324,R326,R341,R362,R417
V101237	R	MF	1K2	J	R422
V101238	R	MF	1K5	J	R33
V101239	R	MF	1K8	J	R429
V101240	R	MF	2K2	J	R149,R153,R166,R249,R253,R266, R349,R353,R366,R421
V101242	R	MF	3K3	J	R23 ,R34
V101243	R	MF	3K9	J	R28 ,R29 ,R30 ,R31 ,R32
V101244	R	MF	4K7	J	R103,R110,R177,R18 ,R203,R210, R277,R303,R310,R377
V101245	R	MF	5K6	J	R154,R155,R254,R255,R354,R355
V101246	R	MF	6K8	J	R139,R140,R239,R240,R339,R340
V101248	R	MF	10K	J	R104,R138,R14 ,R171,R186,R204, R238,R271,R286,R304,R338,R36 , R37 ,R371,R386,R4 ,R404,R418, R419,R5 ,R6 ,R8
V101249	R	MF	12K	J	R2
V101251	R	MF	18K	J	R17
V101252	R	MF	22K	J	R403
V101253	R	MF	27K	J	R102,R202,R302

Order number	Description	Item
V101256	R MF 47K J	R13 ,R144,R145,R157,R158,R163, R244,R245,R257,R258,R263,R344, R345,R357,R358,R363
V101258	R MF 68K J	R152,R252,R352
V101259	R MF 82K J	R151,R251,R351
V101260	R MF 100K J	R156,R168,R169,R256,R268,R269, R356,R368,R369,R423,R426
V101268	R MF 470K J	R420
V101272	R MF 1M J	R10 ,R3 ,R7 ,R9
V101273	R MF 1M2 J	R11
V101280	R MF 4M7 J	R148,R165,R248,R265,R348,R365
V1026007	R MF 10K F	R407,R413,R414
V1026117	R MF 13K F	R408
V1026147	R MF 14K F	R415
V1026206	R MF 1K62 F	R136,R236,R336
V1026227	R MF 16K9 F	R406
V1026266	R MF 1K87 F	R164,R264,R364
V1026278	R MF 191K F	R159,R259,R359
V1026335	R MF 221E F	R109,R209,R309
V1026377	R MF 24K3 F	R409
V1026516	R MF 3K40 F	R117,R217,R317
V1026676	R MF 4K99 F	R1
V1026685	R MF 511E F	R111,R211,R311
V1026844	R MF 75E F	R101,R15 ,R16 ,R201,R301,R305
V1026866	R MF 7K87 F	R405
C102944	R MF 4K7 J	R427
V103438	R MO 1K5 J	R127,R128,R227,R228,R327,R328
V1061024	R T CEMH 220E M	P102,P103,P202,P203,P302,P303
V107004	R T CEMH 200E M	P101,P201,P301
V107009	R T CEMH 10K M	P105,P205,P305
V107258	R PCFM H 10K L 0W4	P1 ,P2
V1075223	R M CE 200E K	P104,P204,P304
V1075301	R M CE C 50K K	P107,P207,P307
C1113889	CELPR 47M M 100	C130,C230,C330
V1114149	CELPR 1M M5 160	C414
V1114155	CELPR 10M M5 160	C117,C147,C217,C247,C317,C347
V111474	CELPR 1M M5 400	C131,C231,C331,C415
V111477	CELPR 100M M5 25	C422
V1114855	CELPR 22M M5 50	C418,C420
V1115105	CELPR 22M M5 25	C109,C113,C121,C129,C134,C145, C18 ,C209,C213,C221,C229,C234, C245,C309,C313,C321,C329,C334, C345
V1115115	CELPR 47M M5 25	C405,C406,C5
V1115315	CELPR 10M M5 50	C16 ,C19 ,C4 ,C421
V1115465	CELPR 1M M5 50	C1 ,C2
V1115505	CELPR 4M7 M5 50	C107,C207,C307
V111679	CELBI 10M MAC 25	C8
V111681	CELBI 22M MAC 25	C101,C201,C301
V112231	CNP0 MI 12P G5 63	C146,C246,C346
V112236	CNP0 MI 33P G5 63	C140,C240,C340,C6 ,C7
V112241	CNP0 MI 82P G5 63	C115,C215,C315
V112242	CNP0 MI100P G5 63	C3
V112362	CN750MI100P G5 63	C411
V112366	CN750MI220P G5 63	C144,C244,C344
V112739	CCE MI 1K K5 63	C126,C136,C142,C226,C236,C242, C326,C336,C342,C410
V1127510	CX7R MI 10K K5 63	C124,C150,C224,C250,C324,C350

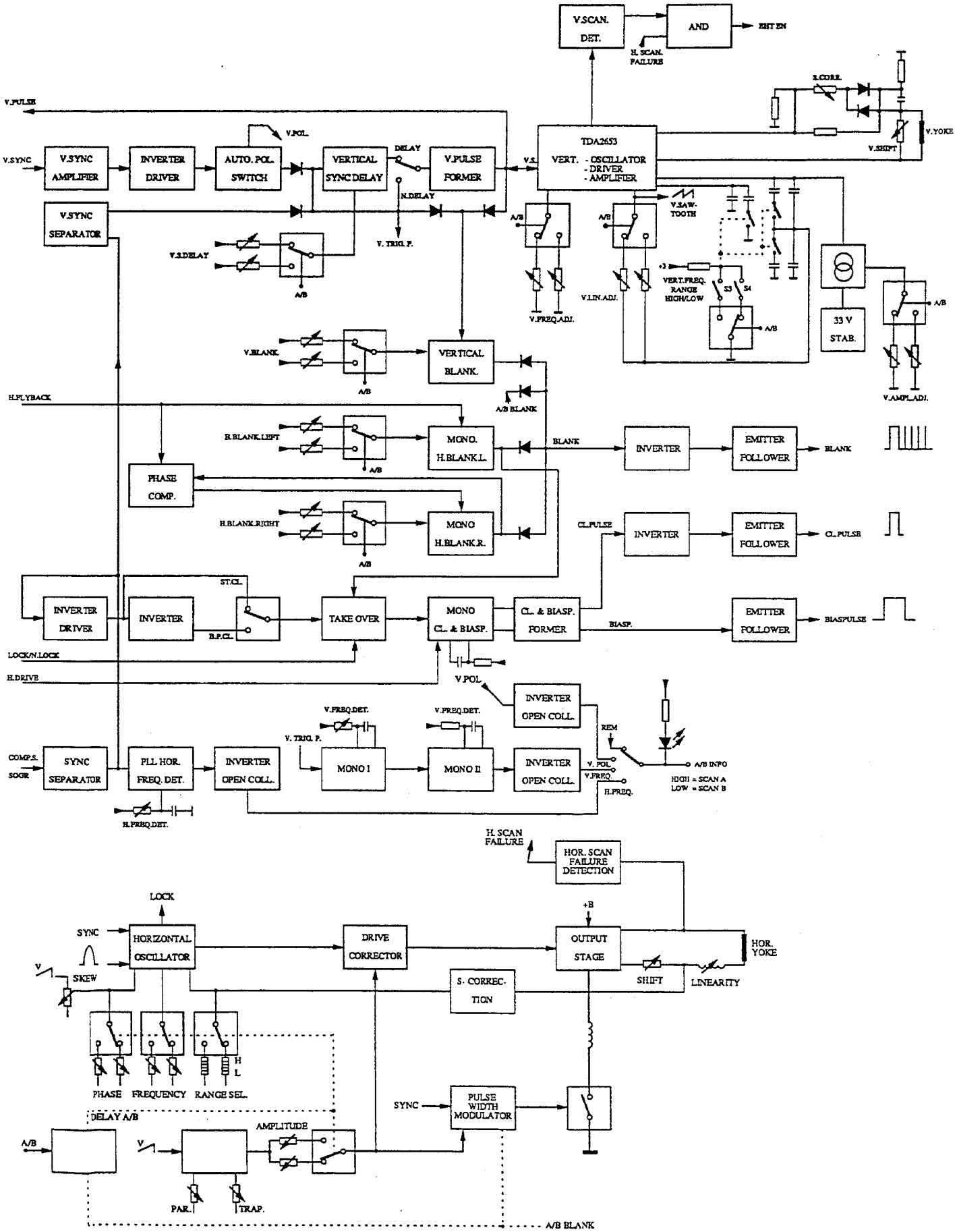
Order number	Description	Item
C112763	CCE MI 10K U5 63	C106,C108,C110,C114,C139,C206, C208,C210,C214,C239,C306,C308, C310,C314,C339
V1127760	CX7R MI220K M5 100	C118,C141,C218,C241,C318,C341
V1127830	CX7R MI100K K5 50	C10 ,C104,C11 ,C119,C12 ,C120, C122,C125,C127,C128,C13 ,C132, C133,C137,C138,C14 ,C15 ,C204, C219,C220,C222,C225,C227,C228, C232,C233,C237,C238,C304,C319, C320,C322,C325,C327,C328,C332, C333,C337,C338,C401,C402,C403, C404,C407,C408,C409,C412,C417, C419
V1127890	CX7R MI470K K5 63	C116,C216,C316
V1127930	CX7R MI 1M K5 63	C413
C112827	CCE DI 1K5 S 400	C416
V114080	CPOMEPO 10K K5 63	C135,C235,C335
V114082	CPOMEPO 22K K5 63	C123,C223,C323
V114088	CPOMEP0100K K5 50	C103,C17 ,C203,C303
V114090	CPOMEP0220K K5 50	C112,C212,C312
V114096	CPOMEPO 1M K5 50	C9
V117009	CFDTRH 1.8/22P 100	C105,C205,C305
V117024	CFDTRH 4.0/40P 100	C111,C211,C311
V1314073	SMCTRA BC 547 C	Q223,Q3
V131411	SMCTRA BC 549 C	Q110,Q118,Q210,Q218,Q310,Q318, Q401,Q402,Q6 ,Q7
V1314133	SMCTRA BC 557 C	Q4 ,Q5
V1314182	SMCTRA BC 559 C	Q102,Q202,Q302,Q404
V131464	SMCTRA BF 199	Q101,Q201,Q301
V1314651	SMCTRAFET BF 245 B	Q117,Q121,Q217,Q221,Q317,Q321, Q403
V131494	SMCTRA 2N3904	Q115,Q116,Q215,Q216,Q315,Q316
V1315046	SMCDIO BAT 86	D107,D108,D207,D208,D307,D308
V131620	SMCDIO 1N6263	D110,D111,D210,D211,D310,D311, D402
V1316211	SMCDIO 1N4148	D101,D109,D201,D209,D3 ,D301, D309,D401,D7
V131637	SMCDIO BA 158	D104,D105,D204,D205,D304,D305
V131643	SMCDIO 1N4151	D1 ,D2
V131645	SMCDIO 1N4448	D112,D113,D212,D213,D312,D313
C131646	SMCDIOREC 1N4007	D405,D406,D6
V131740	SMCDIOZEN 0.5W C 12	D403,D404
V131752	SMCDIOZEN 0.5W C 75	D106,D206,D306
V131756	SMCDIOZEN 0.5W C7V5	D103,D203,D303
V131763	SMCDIOZEN 0.5W B5V1	D5
V132194	SMCICLOPA TL 072	U104,U204,U304,U403
V132504	SMCTRA 2N2369 A	Q1
V132507	SMCTRA BF 324	Q107,Q207,Q307
V132516	SMCTRA BF 422	Q119,Q219,Q319
V132520	SMCTRA 2SC3599 E	Q112,Q212,Q312
V132546	SMCTRA BFX 89	Q103,Q104,Q105,Q106,Q109,Q203, Q204,Q205,Q206,Q209,Q303,Q304, Q305,Q306,Q309
V132575	SMCTRA BC 517	Q122,Q222,Q322
V132594	SMCTRA MRF544	Q111,Q113,Q211,Q213,Q311,Q313
V132595	SMCTRA MRF545	Q114,Q214,Q314
V132597	SMCTRA BFQ 63	Q108,Q208,Q308
V132618	SMCTRAFET BSS 101	Q120,Q220,Q320,Q406
V132624	SMCTRAFET BSS 92	Q405

Order number	Description	Item
V133012	SMCTRA COOLER TO 5	
V1330135	SMCTRAFIX 5MM TO 5	
V1330145	SMCTRAFIX 5MM TO 18	
V133043	SMCTRA ISO PL TO220	
V133047	SMCTRA COOLER TO220	
V1330515	SMCTRA COOLER TO126	
C133054	SMCTRA CLIP SOT93	
V133076	SMCTRA WASHER TO 5	
C134002	SMCICLVOL 78 12	U401
V134005	SMCICLVOL LM 339	U6
C134011	SMCICLVOL 79 05	U402
V134018	SMCICLVOL TL 431CLP	U101,U201,U301,U404,U405
V134044	SMCICLVOL LM2940 CT	U7
V134135	SMCICLOPA MC34082P	U102,U202,U302
V134213	SMCICLOPA OP 77GP	U105,U205,U305
C137207	SMCICL 75 189	U5
V137232	SMCICM 80 31	U1
V137259	SMCIC DAC TDA8444	U4
V1372691	SMCICDMEM 27C 64-20	U3
C137498	SMCICD 74LS373	U2
C302108	CORE 3.7X 1.2X 3.5	
V306100	CHOKE AX NS 9 UH	L104,L105,L204,L205,L304,L305
V3061443	CHOKE AX S 100 UH	L103,L203,L303
V306800	XTAL INSULATOR HC43	
V306821	XTAL 11059.200 KC	Y1
V313104	CON FOB TE BNC	J10 ,J11 ,J12 ,J13 ,J14 ,J5 , J6 ,J7 ,J8 ,J9
C3132441	CON DIL RM15.24 P40	
C3132531	CON DIL RM15.24 P28	
C313454	CON MOB .187 .5 P 1	
V3135016	CON FOB TE DSUB P 9	J2
V3137040	CON MOB TE MTIS P 4	J101,J15 ,J201,J301
V3137090	CON MOB TE MTIS P 9	J16
V3137100	CON MOB TE MTIS P10	J4
V3137120	CON MOB TE MTIS P12	J3
V3137170	CON MOB TE MTIS P17	J1
V3153111	CON MOB 9 D2.5 P 1	
V3153112	CON MOB 20 D2.5 P 1	
V324150	SW SLIDE TE DPDT	S101,S2 ,S201,S3 ,S301,S4
V3481004	JUMPER 0.6 2.54 MM	
C348101	JUMPER 0.6 5.00 MM	P106,P206,P306
C3482005	SLEEVE D1.5 5MM	
V3570992	KNOB D 6.0	
V362122	SMP+M M3 X 8 D7985	
V366102	NMH M M3 D 934	
V367502	WASHER LA 3.2 D6798	
V368548	STANDOFF M3-10 FESN	
V5629415	UN AUT HOR SYNC ICD4	
V716543	PCB TESTPOINT 04	TP1 ,TP10,TP11,TP13,TP14,TP2 , TP20,TP21,TP23,TP24,TP3 ,TP30, TP31,TP33,TP34,TP41
V752024	PCB RGB IN-OUT CD6	
V7730541	CHOKE NO S 5.0UH	L102,L202,L302

DEFLECTION BOARD



BLOCKDIAGRAM OF THE HORIZONTAL & VERTICAL DEFLECTION BOARD



CIRCUIT DESCRIPTION

A. General : automatic selection between scan A and scan B.

This display can be preset to handle two input signals (scan A and scan B) with different horizontal frequency and/or different vertical frequency. The selection between scan A and scan B is completely automatic. The parameter on which the selection is based depends on the position of
switch S2 ("A/B SELECT") on the H & V deflection board. This switch can be set in 4 different positions:

1. Position 1: scan A/B selection is based on the horizontal frequency of the incoming signal (lowest frequency is scan A).
2. Position 2: scan A/B selection is based on the vertical frequency of the incoming signal (lowest frequency is scan A).
3. Position 3: scan A/B selection is based on the vertical sync polarity of the incoming signal.
4. Position 4: scan A/B selection is based on the information available at the remote control connector.

Position 1: "Horizontal frequency" used as parameter

The negative horizontal sync pulse is applied at pin 14 of phase comparator U13 (4046). Here the horizontal frequency of the incoming signal is compared to a reference oscillator frequency, adjustable with P17 ('HOR SWITCHING FREQ'). The adjusted frequency determines the switching frequency. Switch S5 must be set in 'SERVICE' position when adjusting the reference oscillator. When the frequency of the applied signal is higher than the reference frequency, then one becomes a high voltage level at pin 13 of U13. Via R105 and R106, Q23 switches on, pulling the voltage level at the A/B info line down via switch S2 in position 1 and scan B is selected. This is indicated by the green led D27.

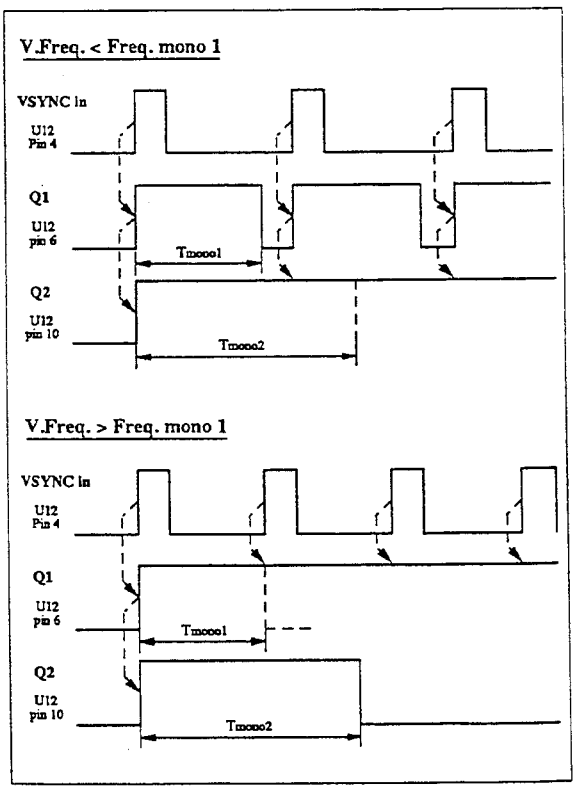
Position 2: "Vertical frequency" used as parameter

The comparison between the vertical frequency of the applied signal and the adjusted reference frequency is done by two retriggerable monostable multivibrators built around U12. The adjusted frequency of the first monostable multivibrator adjustable with P18 ('VERT SWITCHING FREQ')determines the switching frequency. The second monostable multivibrator has a fixed frequency of approximately 30 Hz. Two situations are possible:

** The vertical frequency of the applied signal < frequency of first mono (see figure below)*

The leading edge of the positive vertical sync pulse applied at pin 4 of U12 triggers the first monostable multivibrator causing a high voltage level at pin 6 of U12 during time t1. This low-to-high transition triggers the next monostable multivibrator via pin 12. Because the output of the second monostable multivibrator is still high when a next trigger pulse of the first monostable arrives, the second monostable is retriggered and the output pin 10 remains high. Transistor Q22 is blocked caused by the low voltage level at pin 9 of U12. This means that there is a high voltage level available at the A/B info line via switch S2 in position 2 and scan A is selected.

** The vertical frequency of the applied signal > frequency of first mono (see figure below)*
The leading edge of the positive vertical sync pulse triggers the first monostable multivibrator causing a high voltage level at pin 6 of U12. This transition triggers the next monostable multivibrator at pin 12. Because the output of the first monostable multivibrator is still high when a next sync pulse arrives, the first monostable is retriggered and the output remains high. After time t2 the output pin 10 of monostable 2 goes low, causing a high voltage level at pin 9 of U12. Q22 switches on selecting scan B.



Position 3: "Vertical polarity" used as parameter

The vertical sync pulse is applied to pin 12 of U4d. This pulse can be positive or negative going, according to the polarity of the vertical sync input signal. With a positive going pulse C29 can not be charged sufficiently and pin 9 of U4c remains low. According to the position of jumper J3, the level at pin 9 will be inverted or not in the EXOR gate. Via R51, Q9 and switch S2 in position 3 the A/B info line can be activated.
The logic used is represented in following table:

Polarity vertical sync input signal	J3	Selected scan
positive	low	A
negative	low	B
positive	high	B
negative	high	A

Position 4: switching through remote control

The selection of scan A or B depends on the information at the 9 pin remote control connector. 2 possibilities are available:
- apply the correct RS232 data (see interconnecting protocol manual) at pin 3.
- apply a low at pin 4 to select scan B.

B. Vertical deflection

1. Vertical sync processing

Separate vertical sync
The vertical sync, arriving at pin 7 of J-DA, is applied via R209 and C24 to the base of Q7, where the pulse will be amplified. The clamper C25, D8 adapts the DC level of the amplified sync signal to drive the EXOR gate U4 via transistor Q8.

Automatic polarity switch
The automatic polarity switch is formed by R47, C29 and U4d. One becomes always a positive vertical sync signal at pin 11 of U4d, independent of the polarity of the incoming sync signal. The output of U4d is applied to the anode of D9.

Composite sync
From U26 pin 1, the composite sync arrives via C26 at the double integrator R49, R50, C27 and C28, which functions as vertical sync separator. This results in a negative vertical sync at pin 6 of U4b, which on its turn inverts the vertical sync arriving at the anode of D10. D9 and D10 operate as an AND function, so that at the cathodes vertical trigger pulses are obtained from the separate or the composite sync. When both signals are available, then the separate sync has priority as the composite sync coming through the sync separator is delayed.

Vertical sync delay
From the cathodes of D9, D10 the signal goes in two directions. One way is directly to jumper J4, the other way is through U6b to J4. U6 is an adjustable monostable multivibrator, triggered with the leading edge of the vertical sync, making pin 10 high and pin 9 low. After a short delay adjustable with P9 for scan A and with P10 for scan B pin 9 goes high. This edge will be used as delayed vertical sync, causing an upward shift of the picture. According to the position of J4 this delayed or the non delayed sync is applied to pin 1 of U4a via a differentiator C33, R58. D18 is to suppress the negative going pulses. At pin 3 positive pulses with fixed width are obtained, triggering pin 2 of U1 via R59 and D19.

2. Vertical output stage
The vertical output stage is built around U1 (TDA2653A). This IC incorporates following functions:

- the vertical oscillator, switchable between 2 ranges: 45-65 Hz (low) or 65-85 Hz (high). Selection is realised with S3 for scan A and S4 for scan B, adding in parallel C5 to C4 via switch U3. S3 or S4 is selected according to the A/B info available at pin 9 of U5. In each range the frequency adjustment is possible by P3 (A) or P4 (B) selected according to the A/B info available at pin 9 of U2.

- the blanking pulse generator. Pin 2 of U1 is an input for the vertical trigger pulse but is also the vertical blanking output. To short the flyback time, the oscillator is switched to a higher frequency by means of Q2 and R15, during this blanking pulse.

- the sawtooth generator, built around C7 and C9. These capacitors are loaded with a constant current from Q4. In the high range C6 and C8 are added in parallel with C7 an C9. By changing the loading current an amplitude adjustment is possible with P5 (A) or P6 (B), selected according to the A/B info available at pin 11 of U2. Via R2 and P1 (A) or P2 (B) part of the sawtooth signal available at pin 3 of U1 is fed back allowing linearity control. P1 or P2 is selected according to the A/B info available at pin 10 of U2.

- the flyback generator, which output is available at pin 7 of U1. The flyback pulse available at this pin is used to double the power supply of the output stage at pin 5 during the vertical flyback via R21 and C16. This makes a short flyback time possible.

MC-Service

- the output stage, driving directly the vertical deflection coil. Via R33, C21, R29 and R30 a DC feedback is realised. The circuit around P9 is necessary for the AC feedback and the S-correction

3. Vertical shift adjustment

The vertical shift adjustment is obtained by regulating the current through Q5, Q6 with P7.

4. Vertical S correction

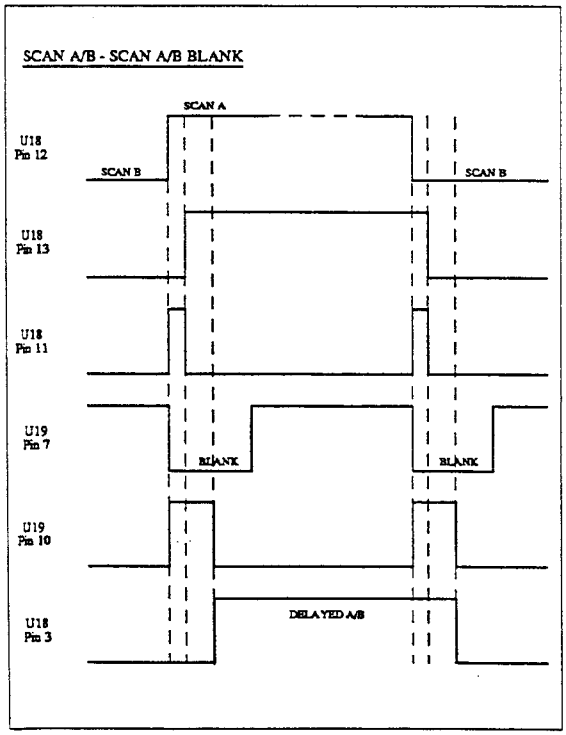
AC feedback is realised with network R109, R31, R32, D5, D6, R37 and P8 which allows S-correction.

C. Horizontal deflection

The horizontal deflection can handle frequencies between 15 and 36 kHz, divided in 5 ranges: LOW (15 - 17.9 kHz), MED/LOW (17.9 - 21.3 kHz) , MED (21.3 - 25.4 kHz), MED/HIGH (25.4 - 30.2 kHz) and HIGH (30.2 - 36 kHz).
Two different horizontal frequencies can be preset and selected according to the level at the A/B info line. For these two presets also the hor. phase and hor. picture size are separately adjustable.

1. A/B switching

To ensure a safe switching from scan A to scan B and vice versa the horizontal amplitude is reduced to a safe value. This is realised with the double monostable multivibrator U19.



The first monostable with output at pin 7 generates the A/B blank pulse, starting at any transition of the A/B info line. The pulse duration is fixed and determined by R128 and C89. This pulse is used to switch the horizontal power supply to a lower level via R156, D50. The same pulse is also used to blank the picture via D30 during scan A/B switch over.
The second monostable with output at pin 10 generates the delayed A/B info. This info line switches the range, the frequency, the phase and the hor. size.

2. Horizontal oscillator

The hor. oscillator is built around U15 (TDA2595). The hor. sync pulses arrive at pin 11. The hor. frequency of the HIGH range is determined by capacitor C76 and the value of the resistor network R120, 121, 211 and P27 (A) or P26 (B). When the correct frequency is set U15 pin 7 goes high. For the other ranges extra capacitors C77, 78, 79 or 80 are connected in parallel via the analog switches of U16. These analog switches are selected according to the position of the range selectors for scan A or B. Through U18b only one of the range selectors is active.
On U15 pin 4 the drive pulses are leaving. The duty cycle is independent of the frequency. The phase of the drive signal is maintained stable by comparing the horizontal flyback pulses arriving via R125, 124 at U15 pin2 with the oscillator signal. The correct phase is adjusted with P24 (A) or P25 (B).

3. East-west correction

To control the hor. amplitude and to compensate for the east-west distortion of the picture a feed back system is used. As reference the signal applied at pin 5 U23b is used. This signal is composed of a DC component, a vert. sawtooth and a vert. parabola signal.
The DC component is adjusted with P22 (A) or P23 (B), selected according to the delayed A/B info arriving at U17 pin 9. These pots make a hor. amplitude adjustment possible by simply changing the power supply voltage at the output stage.
By modulating this DC voltage with a vert. parabola signal, derived from a vert. sawtooth signal coming from U1 pin 3 and applied to C94 via Q24 parabolic correction is possible, adjustable with P20. By modulating with a vert. sawtooth adjustable with P21, trapezium correction is possible.
Also skewing adjustment is possible with P24 (A) or P25 (B). Therefore a vert. sawtooth is applied at the base of Q25 via emitter follower Q24. On the emitter of Q25 the non inverted sawtooth is available and on the collector the inverted sawtooth is available. So it is possible to vary between a positive or a negative sawtooth, which is applied via C85, R115 to the phase comparator U15 pin 3.

4. Horizontal driver

The drive pulses available at U15 pin 4 are applied to Q30 via D53, D54. In the collector of Q30 a transfo is used which receives power supply via a current source Q28, controlled by U23 via Q27. At the input of U23 pin 3 a voltage is applied which is a measure for the horizontal amplitude. This voltage is transformed into current by U23a and Q27. In this way the drive pulses and consequently the basis current for Q31 is adapted according to the horizontal amplitude.

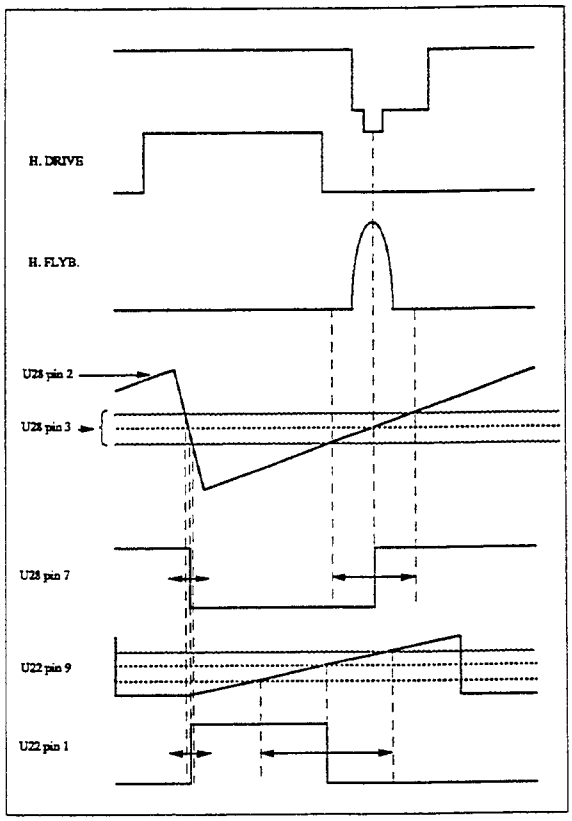
5. Output stage

The horizontal output stage is built around the deflection transistor Q31, the recuperation diode D51, the flyback capacitors C117 and C118 and the S-correction capacitors C120 - C124.
The drive pulses for Q31 arrive via transfo T1. When Q31 switches off, a flyback pulse is generated over C117 and C118. The flyback time can be increased by shorting C117 with jumper J10 (LONG), so reducing the amplitude of the pulse.
The linearity of the sawtooth current in the deflection yoke can be adjusted with L5.
The S-correction capacitor is automatically adapted to the correct value, by switching one or more capacitors in parallel with C120. This is realised with transistors Q35,36 and 37, together with diode matrix D41 - 47. This matrix receives its info from the scan range selectors.

6. Horizontal power supply control

The amount of energy applied to the output stage is determined by the on time of Q29. This mosfet is driven from a pulse width modulator U22.
The internal oscillator frequency is determined by C103 and synchronised with the signal applied to pin 11. This signal is coming from a comparator U28 via differentiator C101,R170. The positive input of the comparator receives the hor. oscillator signal from U15 pin 16; the negative input receives the east-west reference signal from U23b via R210. In this way a small phase shift is realised for the sync signal according to the east-west reference signal.
The same east-west reference signal, applied via R152,157 to comparator U20 is used to be compared to the signal at the negative input. At this input part of the reference voltage available over C110 is applied. This voltage is derived from the rectified flyback pulses available from the secondary winding of T2. In the long flyback time position of J10 transistor Q39 is conductive, so shorting R165 and adapting the feedback reference voltage. The resulting correction voltage available at the output of U20 is applied to U22 pin 9 to control the duty cycle of the pulse width modulator, so controlling the horizontal amplitude.

Pin 12 of U22 is pulled down when switching from scan A to B or vice versa. At this moment the duty cycle of the pulse width modulator is decreased, resulting in a low horizontal amplitude during the switching over.



D. Blanking

1. Vertical blanking

The vertical blanking pulse is generated by the monostable U6a at pin 7. This monostable is triggered at pin 4 via D15 from the incoming sync pulses. In case no sync pulses are available at the input, then the blanking pulses generated during the vertical retrace at pin 2 of U1 are used as trigger via R53, D16. The vertical blanking duration is set by P11 (A) or P12 (B), selected according to the A/B info available at U5 pin 11.

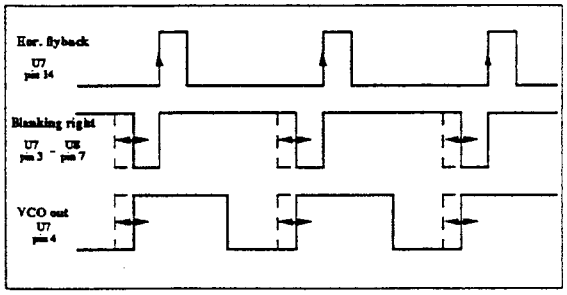
2. Left horizontal blanking

The left horizontal blanking pulse is generated by the monostable U8 at pin 9. This monostable is triggered at pin 12 via the differentiator C40,R71 by the hor. flyback pulses. The left hor. blanking duration is set by P15 (A) or P16 (B), selected according to the A/B info available at U5 pin 10.

MC-Service

3. Right horizontal blanking

The right horizontal blanking pulse is generated by the monostable U8 at pin 7. This monostable is triggered at pin 4 from the PLL U7. This PLL locks the leading edge of the hor. flyback pulse applied at U7 pin 14 to trailing edge of the blanking pulse available at U7 pin 3 by changing the phase of the VCO signal at pin 4. The right hor.blanking duration is set by P13 (A) or P14 (B), selected according to the A/B info available at U5 pin 10.



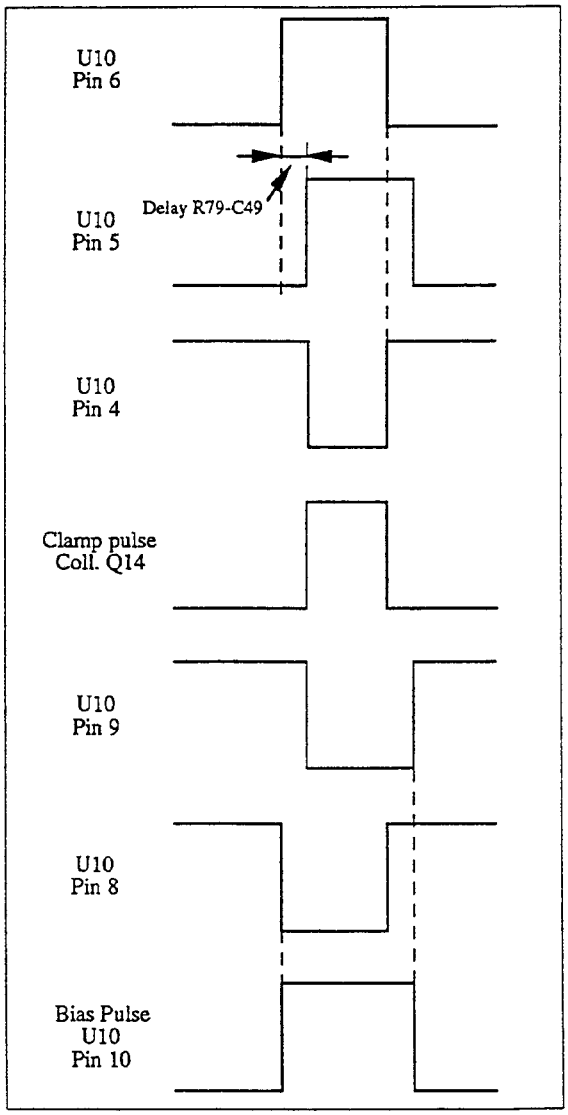
4. Composite blanking

The composite blanking is obtained by mixing 3 signals together over R57: the vertical blanking arriving via D17, the left hor. blanking arriving via D26 and the right hor. blanking arriving via D25. Additionally the A/B blanking pulse is added via D30, to blank the picture when switching from scan A to B or vice versa. This signal is applied to the base of Q10 via a speed up network and finally leaves the board via a double emitter follower Q11,12 to go to the RGB amplifier.

E. Clamping and bias pulse

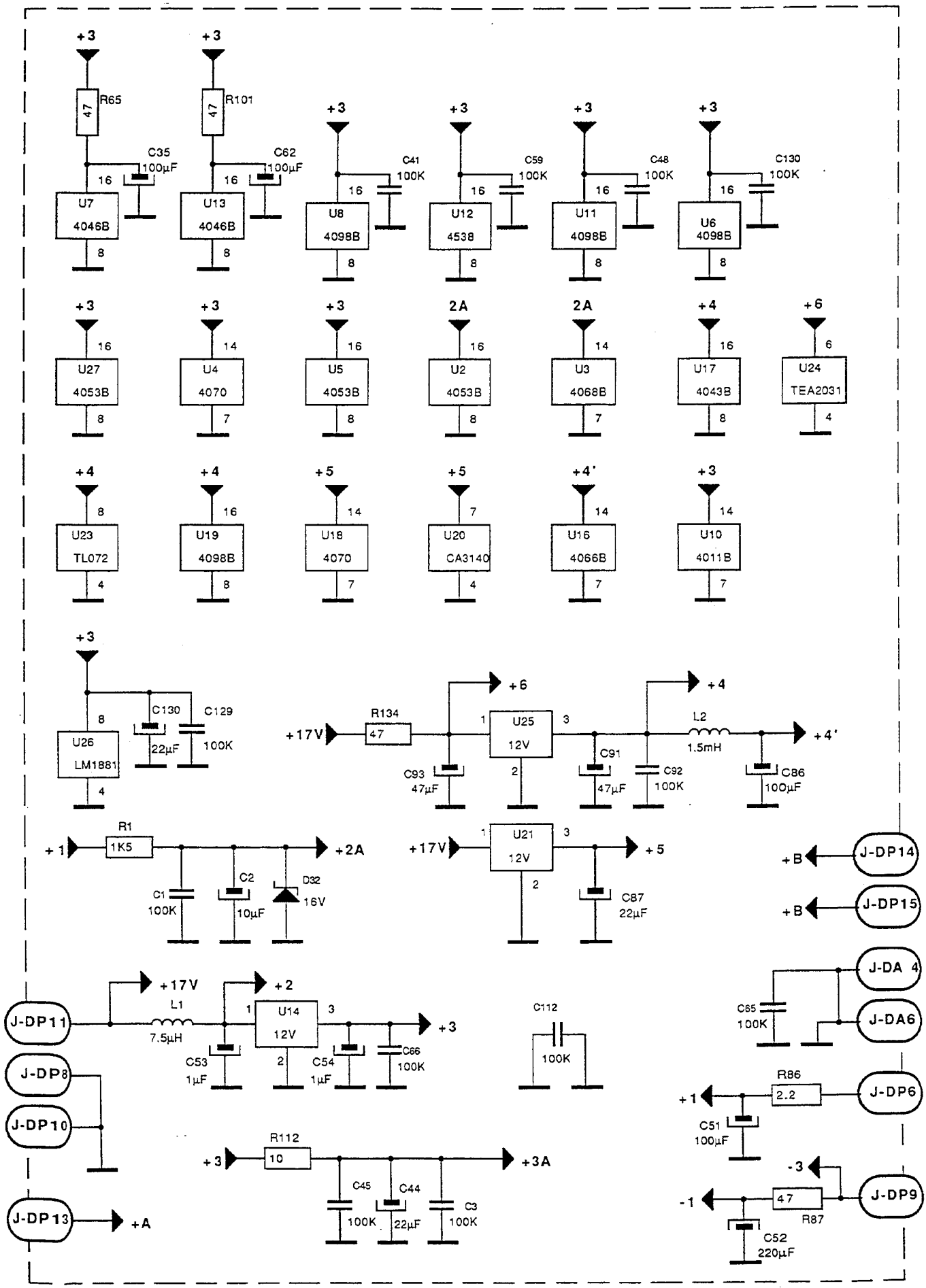
The composite sync, coming from U26 pin 1 is inverted and transformed to C-MOS level by Q40. Now the sync is applied to the NAND U10, used as inverter. According to the position of S8 (A) or S7 (B), selected according to the A/B info available at U27 pin 9, the non inverted signal (back porch clamping) or the inverted signal (sync tip clamping) is selected.
Via switch U27 the signal arrives at the monostable U11 pin 5. The switch is used as take over switch. In case no sync is applied (no lock), then the left hor. blanking signal at pin 2 will be used as trigger pulse for the monostable U11 to ensure proper clamping of the RGB amplifier.
The duration of the pulse available at the output pin 6,7 of U11 is determined by C47 and R78. This output signal is applied directly to U10 pin 6 and delayed by R79, C49 to pin 5. At the output pin 4 one obtains a shorter and delayed pulse. This is the clamp pulse which is applied to the RGB amplifier via Q14 and the double emitter follower Q15,16.

In the same way the bias pulse is generated, by combining the inverted output of the monostable (pin 7) with the inverted delayed pulse at U10 pin 11. So a bias pulse is obtained which starts earlier and ends later than the clamp pulse. Via the double emitter follower Q17,18 this pulse is applied to the RGB amplifier.



F. Safe guard

In case a problem occurs in the hor. or vert. deflection circuits, then the EHT generator is switched off to avoid burning of the CRT phosphors.
If the vert. deflection is OK, the flyback pulses available at U1 pin 7 are rectified and load C20.
If the hor. deflection is OK, the flyback pulses available at the secondary side of T2 are loading C110.
The two voltages are applied respectively to Q3 and Q1, generating a low level when everything is OK. If one of the deflections is faulty, a low is available on the loading capacitor and one of the transistors switches off. Now the high level at the collector of Q3 switches off the EHT.



HOR. + VERT. DEFL. ICD451B A

PARTS LIST OF THE HORIZONTAL & VERTICAL DEFLECTION BOARD
Order number of a complete unit : V5629400

Order number	Description				Item
V1011008	RRCFF	1E	J	0.30	R122
C1011129	RRCFF	10E	J	0.30	R112
V1011209	RRCFF	47E	J	0.30	R101,R65 ,R87
C1012049	RRCFF	2E2	J	0.50	R86
V101205	RRMF	2E7	J	0.50	R39
V101206	RRMF	3E3	J	0.50	R38
V101208	RRMF	4E7	J	0.50	R35
V101212	RRMF	10E	J	0.50	R83
V101216	RRMF	22E	J	0.50	R164
V101219	RRMF	39E	J	0.50	R181
V101220	RRMF	47E	J	0.50	R134
V101224	RRMF	100E	J	0.50	R111,R148,R157,R160,R207,R26 , R31 ,R63 ,R84 ,R85 ,R88 ,R89
V101225	RRMF	120E	J	0.50	R109
V101228	RRMF	220E	J	0.50	R163,R179,R29
V101229	RRMF	270E	J	0.50	R43
V101231	RRMF	390E	J	0.50	R70
V101234	RRMF	680E	J	0.50	R116
V101235	RRMF	820E	J	0.50	R117
V101236	RRMF	1K	J	0.50	R110,R12 ,R123,R147,R173,R185, R187,R189,R209,R37 ,R64 ,R76
V101237	RRMF	1K2	J	0.50	R193,R195,R197,R95
V101238	RRMF	1K5	J	0.50	R1 ,R15 ,R42 ,R46 ,R61 ,R82
V101239	RRMF	1K8	J	0.50	R100,R94
V101240	RRMF	2K2	J	0.50	R141,R200,R71 ,R75
V101241	RRMF	2K7	J	0.50	R145,R176
V101242	RRMF	3K3	J	0.50	R154,R41 ,R69
V101244	RRMF	4K7	J	0.50	R118,R137,R206,R32 ,R49 ,R59 , R79 ,R81 ,R92
V101245	RRMF	5K6	J	0.50	R151,R54 ,R72 ,R73 ,R78
V101246	RRMF	6K8	J	0.50	R103,R68
V101247	RRMF	8K2	J	0.50	R152,R155,R177,R178,R30
V101248	RRMF	10K	J	0.50	R14 ,R194,R196,R198,R202,R27 , R28 ,R40 ,R55 ,R93
V101249	RRMF	12K	J	0.50	R113,R150,R166,R174,R57 ,R62 , R74 ,R80
V101250	RRMF	15K	J	0.50	R104,R105,R77
V101251	RRMF	18K	J	0.50	R25
V101252	RRMF	22K	J	0.50	R144,R146,R17 ,R204,R205,R4 , R5 ,R50 ,R52 ,R53 ,R56 ,R60 , R98
V101253	RRMF	27K	J	0.50	R158,R33 ,R58 ,R96
V101254	RRMF	33K	J	0.50	R102,R124,R138,R139
V101255	RRMF	39K	J	0.50	R140,R143,R153,R170,R3
V101256	RRMF	47K	J	0.50	R13 ,R18 ,R47 ,R51 ,R6 ,R67 , R8
V101258	RRMF	68K	J	0.50	R125,R161,R171
V101259	RRMF	82K	J	0.50	R114,R120,R156,R159,R199,R2
V101260	RRMF	100K	J	0.50	R106,R107,R119,R130,R131,R132, R133,R135,R136,R203,R48 ,R97
V101262	RRMF	150K	J	0.50	R9 ,R91
V101263	RRMF	180K	J	0.50	R149
V101264	RRMF	220K	J	0.50	R115,R127,R129,R24 ,R45
V101268	RRMF	470K	J	0.50	R128
V101270	RRMF	680K	J	0.50	R167,R169
V101271	RRMF	820K	J	0.50	R108

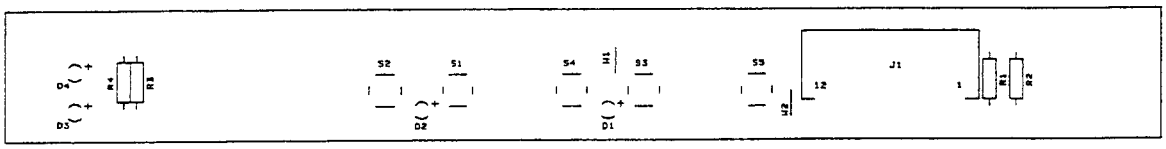
Order number	Description	Item
V101274	RRMF 1M5 J 0.50	R66
V101276	RRMF 2M2 J 0.50	R208,R44 ,R99
V101282	RRMF 6M8 J 0.50	R90
V101549	RRMF 12K F 0.40	R121
V102328	RRMF 220E J 2.50	R36
V102331	RRMF 390E J 2.50	R34
V1026048	RRMF 110K F 0.40	R7
V1026116	RRMF 1K3 F 0.40	R165
V1026506	RRMF 3K32F 0.40	R201
V1026537	RRMF 35K7 F 0.40	R142
V1026680	RRMF 5K11F 0.40	R162
V1026927	RRMF 90K9 F 0.40	R16
V102909	RRMF 5E6 J 1.60	R22
V102912	RRMF 10E J 1.60	R21
V102919	RRMF 39E J 1.60	R180
V102931	RRMF 390E J 1.60	R23
V102934	RRMF 680E J 1.60	R126
V102949	RRMF 12K J 1.60	R11
V102950	RRMF 15K J 1.60	R184,R186,R188
V102951	RRMF 18K J 1.60	R190,R191,R192
V1035483	RRWW H 1K K 4.00	R183
V103612	RRWW H 1E K 4.00	R168
C104670	RRHV 3M9 J 0.50	R182
V106509	RTWW KH 47E K 3.00	P28
V106727	RTCEM H 2K K 0.50	P20
V106728	RTCEM H 5K K 0.50	P21
V106729	RTCEM H 10K K 0.50	P7
V106730	RTCEM H 20K K 0.50	P15 ,P16 ,P17
V106732	RTCEM H 50K K 0.50	P18 ,P22 ,P23 ,P24 ,P25 ,P26 , P27
V106733	RTCEM H100K K 0.50	P11 ,P12 ,P13 ,P14 ,P3 ,P4
V106734	RTCEM H200K K 0.50	P5 ,P6
V106736	RTCEM H500K K 0.50	P1 ,P10 ,P2 ,P9
V107003	RTCEM H100E M 0.50	P8
V107013	RTCEM H100K M 0.50	P19
C1113719	CELPR 1000M M7 50	C15
V111477	CELPR 100M M5 25	C35 ,C62 ,C86 ,C97
V1114809	CELPR 220M M 35	C52
V111481	CELPR 2200M M7 25	C23
V1114869	CELPR 47M M5 40	C10
V1114879	CELPR 100M M 35	C11 ,C16 ,C51
V111494	CELPR 10M M5 63	C19
V1115105	CELPR 22M M5 25	C38 ,C44 ,C57 ,C87
V1115115	CELPR 47M M5 25	C18 ,C91 ,C93 ,C95
V1115315	CELPR 10M M5 50	C2 ,C21 ,C67 ,C94
V1115465	CELPR 1M M5 50	C20 ,C53 ,C54 ,C64
V1115485	CELPR 2M2 M5 50	C99
V1115505	CELPR 4M7 M5 50	C83
V111679	CELBI 10M MAC 25	C24 ,C85
V112230	CNP0 MI 10P G5 63	C55
V112232	CNP0 MI 15P G5 63	C36
V112233	CNP0 MI 18P G5 63	C49
V112234	CNP0 MI 22P G5 63	C124,C50
V112238	CNP0 MI 47P G5 63	C14 ,C34 ,C69 ,C74 ,C98
V112243	CNP0 MI120P G5 63	C47
V112368	CN750MI330P G5 63	C101
V112735	CCE MI470P K5 100	C13 ,C46
C112763	CCE MI 10K U5 63	C125
V1127741	CZ5U MI100K Z5 100	C92

Order number	Description	Item
V1127830	CX7R MI100K K5 50	C17 ,C29 ,C3 ,C30 ,C41 ,C45 , C48 ,C58 ,C59 ,C65 ,C66 ,C68
C112837	CCE DI 10K S 400	C111
V1140221	CPOMEPO 1K8 K 250	C115
V114026	CPOMEPO 4K7 K 250	C109
V1140463	CPOMEPO220K J 100	C104,C105,C106,C107,C114
V1140535	CPOMEP0820K J 250	C116
V1140542	CPOMEPO 1M J 100	C113
V114080	CPOMEPO 10K K5 63	C12 ,C33 ,C37 ,C72 ,C81
V114082	CPOMEPO 22K K5 63	C84
V114083	CPOMEPO 33K K5 63	C22 ,C6 ,C8
V114084	CPOMEPO 47K K5 63	C32
V114087	CPOMEP0 82K K5 63	C7 ,C9
V114088	CPOMEP0100K K5 50	C112,C5 ,C75 ,C88
V114090	CPOMEP0220K K5 50	C25 ,C70 ,C71
V114091	CPOMEP0330K K5 50	C4 ,C60 ,C89 ,C90
V114092	CPOMEPO470K K5 50	C61 ,C82
V114096	CPOMEPO 1M K5 50	C26 ,C56
V114482	CPO P0 2K2 M5 100	C100
V115003	CPPMEP0 10K J 1000	C117,C118
V115007	CPPMEPO 8K2 J 1600	C119
V1150732	CPPMEPO560K K 250	C123
V1150761	CPPMEPO 1M M 160	C120
V1150782	CPPMEPO 1M5 K 250	C122
V1150802	CPPMEPO 2M2 K 250	C121
V115124	CPC PO 1K5 M 400	C110
V115163	CPP PO 2K2 J5 100	C27
V1151632	CPP PO 2K2 H5 100	C76 ,C77
V1151662	CPP PO 3K9 H5 63	C39
V1151673	CPP PO 5K6 H5 63	C63
V115182	CPC PO330P K5 100	C102,C28
V1151821	CPC PO470P K5 100	C40
V116300	CPP PR 1K5 H 63	C78
V1163034	CPP PR 383P F 630	C43
V116311	CPP PR 1K H 160	C79
V116315	CPP PR 4K7 H 160	C31
V116325	CPP PR 470P H 630	C103,C80
V1314073	SMCTRA BC 547 C	Q1 ,Q11 ,Q15 ,Q17 ,Q2 ,Q20 , Q22 ,Q25 ,Q3 ,Q39 ,Q7 ,Q9
V1314133	SMCTRA BC 557 C	Q12 ,Q16 ,Q18 ,Q19 ,Q24 ,Q4
V131426	SMCTRA BC 337	Q6
C1314451	SMCTRA BD 238	Q28
V131620	SMCDIO 1N6263	D5 ,D6
V1316211	SMCDIO 1N4148	D10 ,D11 ,D12 ,D13 ,D14 ,D15 , D16 ,D17 ,D18 ,D19 ,D2 ,D20 , D21 ,D22 ,D23 ,D24 ,D25 ,D26 , D28 ,D29 ,D3 ,D30 ,D33 ,D4 , D40 ,D41 ,D42 ,D43 ,D44 ,D45 , D46 ,D47 ,D49 ,D50 ,D52 ,D7 , D8 ,D9
V131624	SMCDIO BAX 18	D53
V131637	SMCDIO BA 158	D36 ,D37
C131644	SMCDIOREC 1N4001	D1
V131667	SMCDIOLED 3.0MM GRE	D27
V131729	SMCDIOZEN 0.5W C4V7	D34
V131744	SMCDIOZEN 0.5W C5V6	D39
V131762	SMCDIOZEN 0.5W C 16	D32
C131782	SMCDIOZEN 1.3W C5V1	D54
V1319033	SMCDIOREC BYD 33 J	D38

Order number	Description	Item
V131917	SMCDIOREC BY 228	D35 ,D51
V131954	SMCDIOREC BYV27-200	D48
V1321025	SMCICLVOL KA 33 V	D31
V132194	SMCICLOPA TL 072	U23
V132501	SMCTRA BC 327-25	Q5
V132504	SMCTRA 2N2369 A	Q10 ,Q13 ,Q14 ,Q21
V132513	SMCTRA BF 370	Q38
V132516	SMCTRA BF 422	Q27 ,Q35 ,Q36 ,Q37
V132557	SMCTRA BSW 68 A	Q30
V132561	SMCTRAPOW BDT 62 C	Q32 ,Q33 ,Q34
C132562	SMCTRA BC 639	Q26
V132572	SMCTRAPOW BU2508 A	Q31
V132575	SMCTRA BC 517	Q23 ,Q8
V132600	SMCPOWFET BUZ 76 A	Q29
V132744	SMCICLSM TDA8380	U22
V132790	SMCIC TDA2653 A	U1
V1330145	SMCTRAFIX 5MM TO 18	
V1330525	SMCTRA COOLER TO220	
C133054	SMCTRA CLIP SOT93	
C1330541	SMCTRA CLIP SOT93	
V1330542	SMCTRA CLIP TO220	
C133055	SMCTRA ISO PL SOT93	
V1330768	SMCTRA WASHER TO5-8	
V133079	SMCTRA COOLER TO220	
V133087	SMCTRA COOLER MULTI	
C134002	SMCICLVOL 78 12	U14 ,U21 ,U25
V134120	SMCICLOPA CA 3140 E	U20
V137302	SMCICD 4011 B	U10 ,U9
V137303	SMCICD 4066 B	U16
V137318	SMCICL TEA2031 A	U24
V137321	SMCICD 4016 B	U3
V137377	SMCICD 4538 B	U12
V137386	SMCICD 4046 B	U13 ,U7
V137392	SMCICD 4070 B	U18 ,U4
V137395	SMCICD 4098 B	U11 ,U19 ,U6 ,U8
C137700	SMCICD 4053 B	U17 ,U2 ,U5
V137719	SMCICL TDA2595	U15
V302132	CORE 6.0X 3.0X10.0	
C3061562	CHOKE AX NS 1 MH	L2
V306222	COIL 80.0MH 2.0A	L6
V306434	COIL E-W AT4043/ 60	L4
V306436	COIL LINE AT4043/ 65	L3
V306727	TRF DRIV AT4043/ 87	T1
V311061	CON LED TE-SE 3 P 1	
C313286	CON MOB TE 2.54 P 3	J3 ,J4
V3133003	CON MOB TE 3.96 P 3	J10
V3133021	CON F JUMP 3.96 P 1	
V313360	CON MOB TE 2.54 P 5	J6 ,J7 ,J8 ,J9
C3133921	CON F JUMP 2.54 SN	
C313613	CON MOB TE 2.36 P 6	J5
V3137100	CON MOB TE MTIS P10	J2
V3137150	CON MOB TE MTIS P15	J1
C324127	SWITCH 4A	S2
V324150	SW SLIDE TE DPDT	S3 ,S4 ,S5
V3242011	SWITCH SLIDE TE 1U	S1
V3481014	JUMPER 0.6 5.08 MM	C73

Order number	Description	Item
V3481024	JUMPER 0.6 7.62 MM	W13 ,W15 ,W22 ,W25 ,W26 ,W28 , W32 ,W4 ,W41 ,W42 ,W49 ,W5 , W50 ,W53 ,W55 ,W56 ,W58 ,W59 , W60 ,W62 ,W63 ,W65 ,W70 ,W79 , W82 ,W9
V3481034	JUMPER 0.6 10.16 MM	W1 ,W10 ,W17 ,W23 ,W27 ,W3 , W31 ,W35 ,W38 ,W39 ,W48 ,W51 , W52 ,W54 ,W6 ,W74 ,W76 ,W80 , W81
V3481044	JUMPER 0.6 12.70 MM	W16 ,W21 ,W29 ,W33 ,W34 ,W37 , W44 ,W47 ,W57 ,W7 ,W72 ,W73 , W77 ,W78
V3481054	JUMPER 0.6 15.24 MM	W11 ,W12 ,W18 ,W20 ,W24 ,W30 , W43 ,W61 ,W67 ,W68 ,W69 ,W71 , W75
V3481064	JUMPER 0.6 17.78 MM	W36 ,W40 ,W46 ,W66 ,W8
V3481074	JUMPER 0.6 20.32 MM	W14 ,W19 ,W45
C348203	SLEEVE D1.5 17MM	
V362122	SMP+M M3 X 8 D7985	
V363602	SMP+C 2.9X 9.5D7981	
V366102	NMH M M3 D 934	
V367455	RIV.P FE D3.2 L 4.8	
V367502	WASHER LA 3.2 D6798	
V601028	HEATSINK SMPSDIO ICD	
V6020883	HEATSINK VDHD ICD45	
V716543	PCB TESTPOINT 04	TP1 ,TP2 ,TP3
V752060	PCB H&V DEFL ICD45	
V773054	CHOKE NO S 7.5UH	L1
V775161	TRF DRIV 3/UN	T2
V775295	COIL LINEARITY 7351	L5

CONTROL PANEL



Description

General

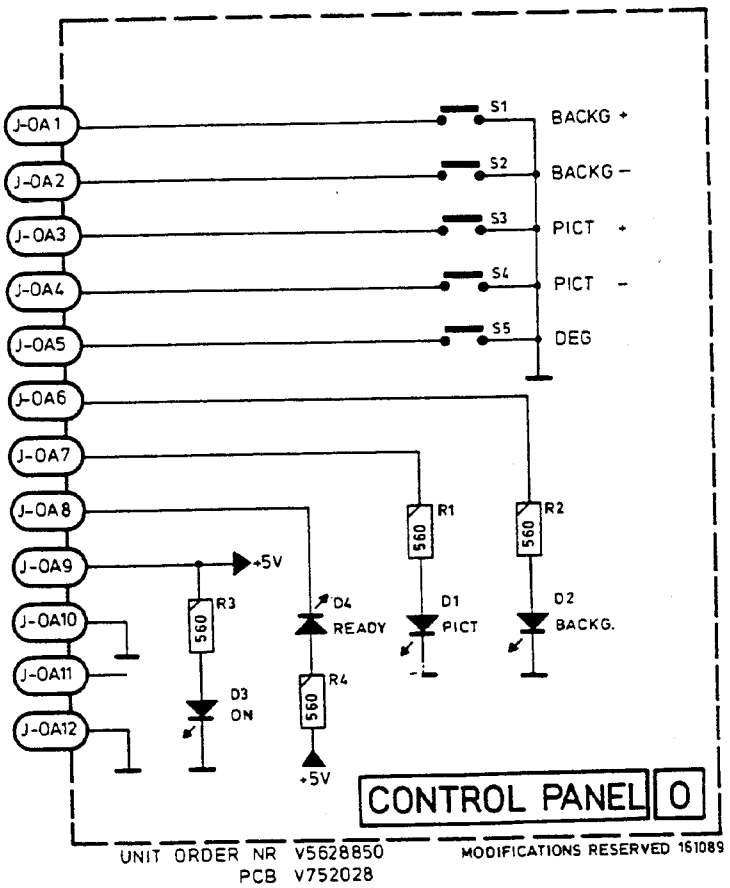
On the control panel several adjustments (DEGAUSS, PICTURE, BACKGROUND) and Led indicators (BACK, PICT, READY and ON) are available.

Circuit description

The control panel is connected with the RGB IN/OUT Amplifier board via the 12 pin J-OA connector. The BACKGROUND UP/DOWN, PICTURE UP/DOWN, DEGAUSS adjustments regulated with S1 ... S5 are applied at the RGB IN/OUT Amplifier board where there will be scanned by the remote control circuit. The Led indicators BACK, PICT, READY are driven by the remote control circuit. The BACKground and/or PICTure led light up when the display is in calibrated position while the READY led lights up in normal operation and switches off when an ERROR is detected. Led D3 (ON) shows if the supply voltage is present.

PRODUCT SAFETY NOTICE

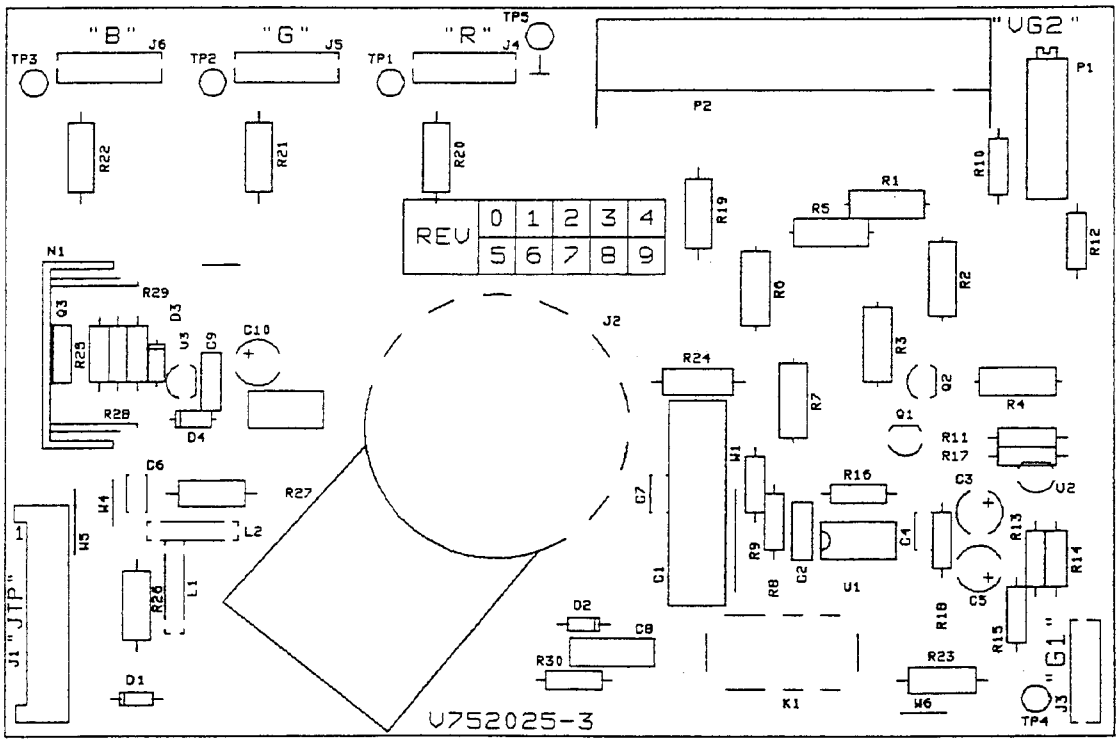
COMPONENTS MARKED WITH ⚠ OR ✻ HAVE SPECIAL CHARACTERISTICS IMPORTANT TO SAFETY. BEFORE REPLACING ANY OF THESE COMPONENTS, READ CAREFULLY THE SERVICE SAFETY PRECAUTIONS.
DON'T DEGRADE THE SAFETY OF THIS SET THROUGH IMPROPER SERVICING.



PARTS LIST OF THE CONTROL PANEL
Order number of a complete unit : V5628850

Order number	Description	Item
V101233	R MF 560E J	R1 ,R2 ,R3 ,R4
V131658	SMCDIOLED 3.0MM YEL	D1 ,D2 ,D4
V131667	SMCDIOLED 3.0MM GRE	D3
V3137320	CON MOB SE MTIS P12	J1
V315354	CON MOC .187 .5 P 2	
V324166	SWITCH TACT TE 1A	S1 ,S2 ,S3 ,S4 ,S5
V3481024	JUMPER 0.6 7.62 MM	W1 ,W2
V3621217	SMP*M M3 X 6 TORX	
V3621227	SMP*M M3 X 8 TORX	
V367502	WASHER LA 3.2 D6798	
V601049	FRONT PANEL 76	
V6010581	FOIL CTRL PANEL CD6	
V752028	PCB CTRL CD6	

CRT SOCKET


"B"
"G"
"R"
"VG2"
TP1
TP2
TP3
TP5
J4
J5
J6
P1
P2
REV
0 1 2 3 4
5 6 7 8 9
R1
R2
R3
R4
R5
R6
R7
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
D1
D2
D3
D4
Q1
Q2
Q3
U1
U2
U3
J1 "JTP"
J2
J3 "G1"
K1
L1
L2
N1
W1
W4
W5
W6
TP4
V752025-3

C.R.T. SOCKET

Description.

The CRT socket contains:
- VG2 stabilizer
- Filament voltage stabilizer
- Spotsuppression

The video signals arrive from the RGB IN/OUTPUT Board and are fed to the three cathodes via R20/R21/ R22. The focus voltage available from the Switched Mode and EHT Power Supply Board is applied via P2 to grid 3 of the CRT making focus adjustment possible.

VG2 stabilizer

The VG2 voltage is adjustable between + 500 V and + 900 V.
Stabilization is obtained by the cascode current source Q1, Q2 which provides a constant voltage at the node of R1, R2 via measurement of VG2. The VG2 is measured via the voltage divider R1, R5, R6, R7, R9 and applied via R8 to the '+' input of U1. This voltage is compared to a reference voltage available at the '-' input which is adjustable via P1 making VG2 adjustment possible. The voltage level at the output of U1 (pin 6) drives Q1 via R16 which affects the VG2 via the collector circuit if necessary.

Filament voltage stabilizer

The heater voltage arrives at contact J-TP3 which voltage is held constant by means of U3 (TL431C) and seriesregulator Q3 (BD433).

Spotsuppression

In normal operation, the grid 1 receives blanking pulses through R23. When the display is switched off, then a low level SPOTCTRL is available from the EHT board via J-TP8, which inactivates K1 connecting G1 at the negative voltage which varies between -120 and -190V, to immediately suppress the spot.

C.R.T. order numbers for ICD451B :

N.P.	V1311662
L.P./S.B.	V1311664

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| | | |

PARTS LIST OF THE CRT UNIT
Order number of a complete unit : V5628822

Order number	Description	Item
V1011088	R CFF 4E7 J	R18
V101224	R MF 100E J	R30
V101232	R MF 470E J	R26 ,R27
V101235	R MF 820E J	R25
V101237	R MF 1K2 J	R15
V101243	R MF 3K9 J	R12
V101244	R MF 4K7 J	R14
V101248	R MF 10K J	R16
V101250	R MF 15K J	R13
V101255	R MF 39K J	R11
V101256	R MF 47K J	R17
V101271	R MF 820K J	R8
V101272	R MF 1M J	R10
V1013801	R MF 5M1 F	R1 ,R5 ,R6 ,R7
V102024	R CC 100E K	R20 ,R21 ,R22 ,R23 ,R24
V102041	R CC 2K7 K	R19
V1026278	R MF 191K F	R9
V1026506	R MF 3K32 F	R29
V1026686	R MF 5K23 F	R28
V104665	R HV 3M3 J	R2 ,R3 ,R4
V107513	R M CE C 10K K	P1
V107618	R PRVR 55M K	P2
V1115105	CELPR 22M M5 25	C3 ,C5
V1115465	CELPR 1M M5 50	C10
C112763	CCE MI 10K U5 63	C9
V1127830	CX7R MI100K K5 50	C4 ,C6
V112833	CCE DI 4K7 S 400	C8
V114084	CPOMEPO 47K K5 63	C2
C114602	CPOMEPO 47K M 1000	C1
V1312611	TUBSURGE PROT 230V	SA1 ,SA2 ,SA3 ,SA4
V131433	SMCTRA BD 433	Q3
V131624	SMCDIO BAX 18	D2
V131627	SMCDIO BAV 21	D1
V1319033	SMCDIOREC BYD 33 J	D3 ,D4
V132500	SMCTRA MPSA44	Q1 ,Q2
V133086	SMCTRA COOLER TO220	
V134018	SMCICLVOL TL 431CLP	U2 ,U3
V134120	SMCICLOPA CA 3140 E	U1
V306100	CHOKE AX NS 9 UH	L1 ,L2
C311034	TUBPICSOC+SG11-13KV	J2
V3135824	CON FOB TE P 4	
V3137100	CON MOB TE MTIS P10	J1
V315311	CON MOB 9 X1.3 P 1	TP5
V315319	CON MOB .250 .8 P 1	
V324346	RELAY 360E 12V 2XU	K1
V3263029	WIRE AWG22 UL EHT	
V348015	SLE SHR 3.2 L20 RED	
V3481034	JUMPER 0.6 10.16 MM	W2 ,W6
V3481044	JUMPER 0.6 12.70 MM	W1
V3481064	JUMPER 0.6 17.78 MM	W3
V348932	WIRE UN CRT CD6	
V362122	SMP+M M3 X 8 D7985	
V366102	NMH M M3 D 934	
V367502	WASHER LA 3.2 D6798	
V716543	PCB TESTPOINT 04	TP1 ,TP2 ,TP3 ,TP4
V752025	PCB CRT SOCKET CD6	

CHAPTER 3 : MAINTENANCE

3.1. CLEANING

CAUTION

Avoid the use of chemical cleaning products,
benzene - toluene - xylene or other solvents,
which may damage the plastics used in bezel, cover and bottom cover.

Clean the display with a soft cloth dampened with mild detergent and water, repeat this with water only and wipe with a dry cloth.

3.2. LED INDICATORS :

The status of the leds, on the front panel, gives the working conditions of the display.

3.2.1. NORMAL LED STATUS :

POWER : illuminates when the display is switched on.

READY : illuminates if deflection circuits are working properly and if EHT is present and if no error or warning message is present.

3.2.2. WHAT TO DO IF :

Not one Led is on : AC power input problem.

- Check if the display is switched on (pushed position of the power switch).
- If OK : check the power connection (display side and line side).
- If OK : check if the line voltage is present (connect another display, a lamp etc...).
- If OK : check power fuse (be sure of the correct fuse rate and input voltage setting, see user manual chapter 2.2)
- If OK and the display does not work, contact your dealer.

Led "POWER" is on but Led "READY" is flashing :

see appendix A "Warnings"

Led "POWER" is on but Led "READY" is not on :

Contact your dealer.

Bad picture display :

a. Coloured stains in displayed picture :

- Eliminate the magnetic fields and push the degauss switch.

b. Geometry and centering faults :

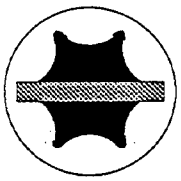
- The factory adjustments for geometry have been done with the aid of a diapositive slide projection.
- It is suggested that this method of adjusting is followed in order to meet specification, see technical manual section "Adjustments".

3.3. REPLACEMENT OF MECHANICAL PARTS :

WARNING

Disconnect the mains cord to prevent electric shocks

NOTE : In this display only "TORX HEAD" screws are used.
For this type of screws one can use a flat head screwdriver as well as a torx head screwdriver.
Please use an adapted screwdriver for each type of screw to prevent damage of the screwhead.

Torxhead 

3.3.1. (TOP)COVER

TO REMOVE :

- Unscrew the 3 fixation screws of the cover, one at the rear of the bottom cover and one at both sides of the bottom cover (see figure 3.1).
- Lift the rear side of the cover about 5 cm (2 inches) and slide it backwards.

TO MOUNT :

- Take the cover so that the rear side is holded about 5 cm higher than the CRT side.
- Slide the top of the cover under the top of the bezel (see detail 1) and push the rear side downwards well seeing that both sides of the cover fit the bezel and the bottom cover.
- Fix the cover with 3 screws (TORX 3.9x16 mm), see location figure 3.1.

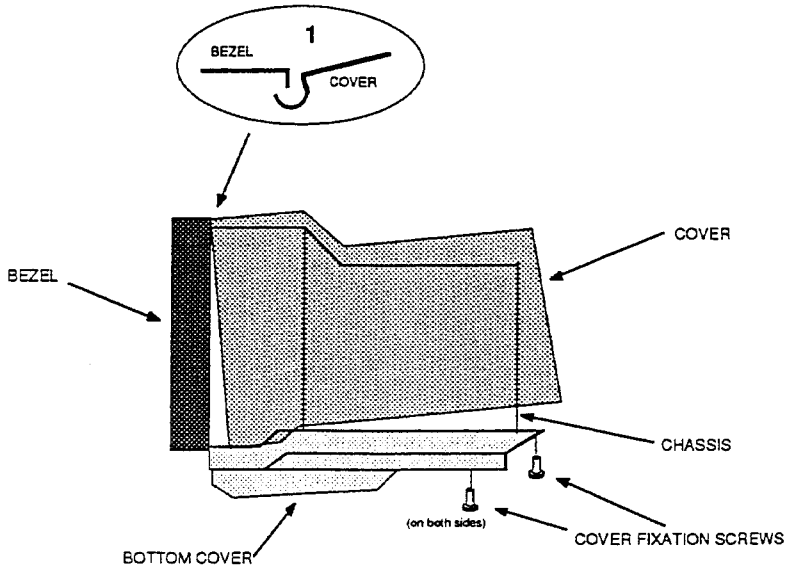


Figure 3.1

3.3.2. BEZEL

TO REMOVE :

- Remove the cover, following the procedure described in 3.3.1.
- Unscrew (2 or 3 turns) the 2 fixation screws on the top and the buttom of the chassis (see detail 1 and 2 of figure 3.2).
- Slide the bezel away from the chassis.

TO MOUNT :

- Slide the bezel so that the 4 fixation pads fit the fixation screws in the chassis as shown in detail 1 and 2 of figure 3.2.
- Tighten the 2 fixation screws on top and buttom.

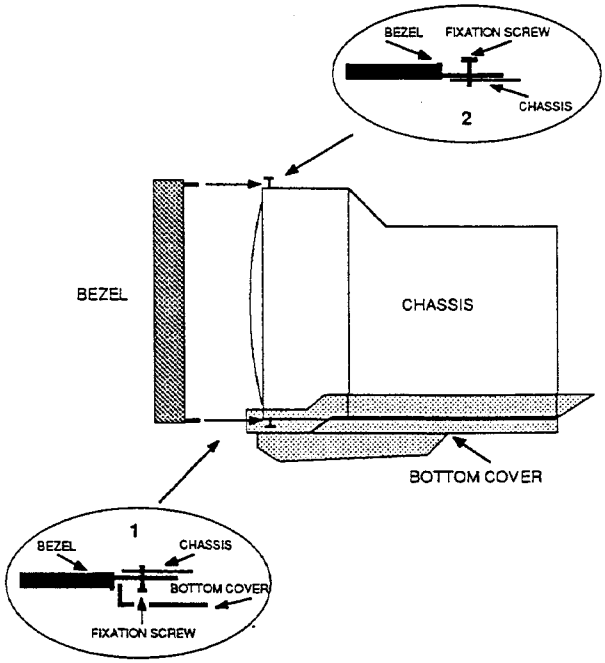


Figure 3.2

3.3.3. BOTTOM COVER

- Remove the cover and the bezel, following the procedures described in 3.3.1 and 3.3.2.
- Remove the different metal shields, top - left - right and rear. Therefore unscrew each fixation screw of the shields 2 or 3 turns and pull upwards.
- The chassis is fixed on the bottom cover with 6 screws from the inside through the chassis in the bottom cover and 3 screws from the outside through the bottom cover in the chassis, see location in figure 3.3.
- Use the inversed method to mount the chassis to the bottom cover.

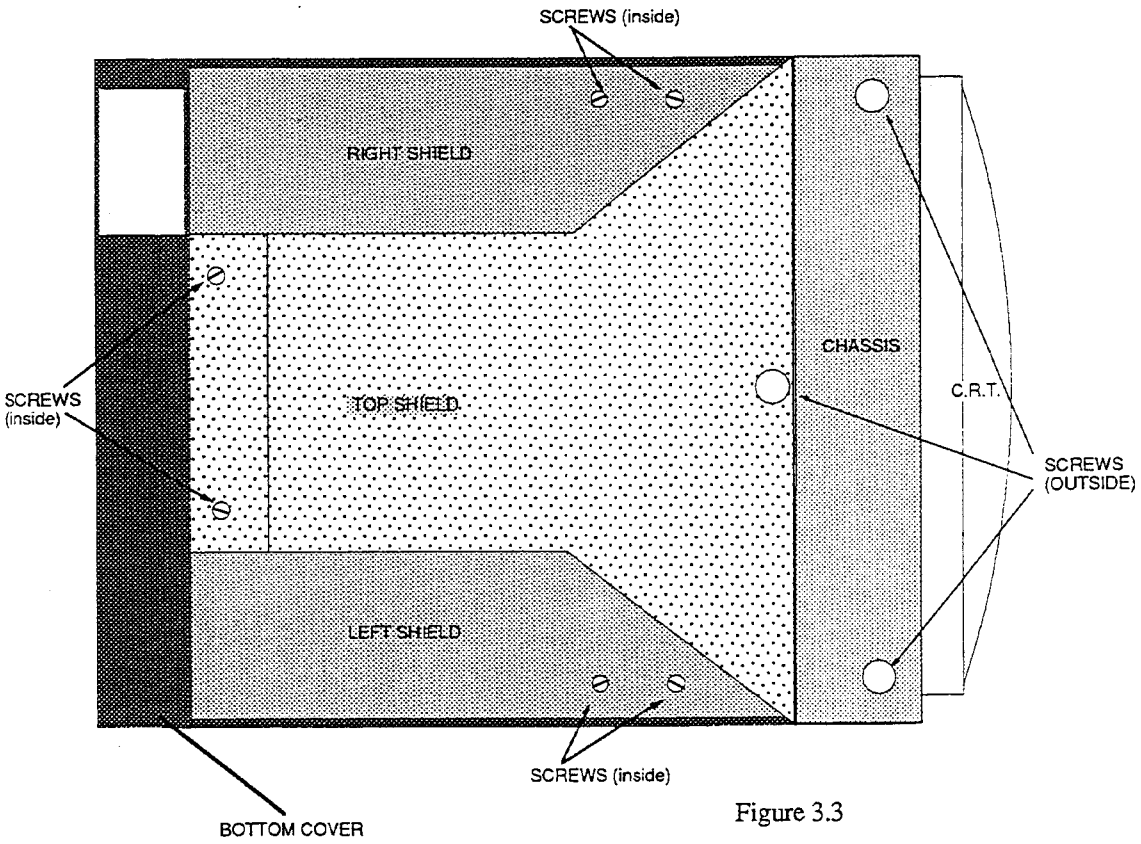


Figure 3.3

3.3.4 CRT (PICTURE TUBE) REPLACEMENT

The crt is mounted on the chassis via the front. This chassis is covered with metallic plates and an ergonomic plastic cover.

WARNING

Do not install or handle the crt in any manner
unless shatter-proof goggles are worn.
People not so equipped should be kept away while c.r.t. 's are handled.
Keep the c.r.t. away from the body while handling.

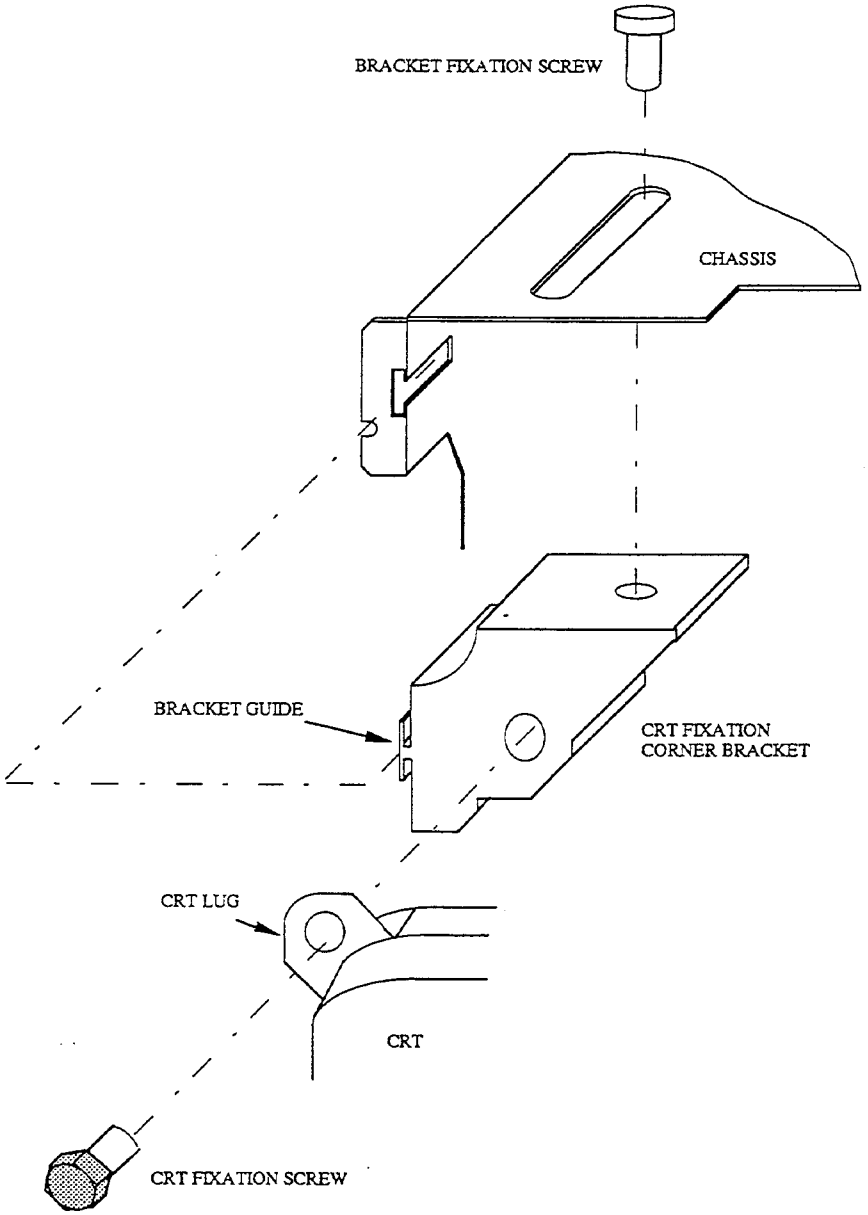
PROCEDURE :

Disconnect the power (mains) lead.
Remove the top cover and the bezel (see 3.3.3).
Remove all the metallic shields to reach the connections of the c.r.t.
Remove the c.r.t. socket and the deflection wiring plug (upper connector J-DY on the deflection board).
Remove the anode lead on the top of the c.r.t.

WARNING

Discharge the anode lead to chassis.
Disconnect the earth wire (from the aquadag) of the
crt socket and discharge the anode of the c.r.t.

The c.r.t is fixed on 4 fixation corner brackets which are mounted on the chassis, see following figure.
Unscrew the 4 c.r.t fixation screws 3 or 4 turns, push the c.r.t. backwards to hold it on its place with one hand while the other hand removes the 4 c.r.t. fixation screws. Ones the screws are removed, you can slide the c.r.t. out of the chassis well looking if neck and deflection yoke passe the degauss coils.



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WARNING

The neck and the pins of the crt are very fragile, even a light shock can damage the crt.

Slide the new c.r.t. (anode to the top) into the chassis while you hold the neck in the center, to pass the degauss coils, without striking the neck.
Push with one hand the c.r.t. to the chassis and start turning the (4) fixation screws with the other hand.
Position the c.r.t. in the center and tighten the screws.
Mount the bezel.
Normally is the space between bezel and c.r.t. equal and fits well. If incorrect (tolerance of the c.r.t. lugs positions) following procedure can be used.
Put the display on a table so that you can reach the bracket fixation screws in the bottom cover.
Unscrew the 4 bracket fixation screws 1 or 2 turns.
Slide the brackets on which is fixed the c.r.t. till the it fits the bezel and tighten the 4 bracket screws again.
Connect the anode lead and the deflection plug. Connect the earth from the aquadag to the c.r.t. socket and mount it.
Before mounting the metallic shields switch on your display and check the linearity. If necessary, follow the adjustment procedure, to make some corrections.
Switch off the display and mount the metallic plates, the bezel and the cover.
The display is ready for use.

CHAPTER 4 : ADJUSTMENTS

This section contains a step by step alignment for the ICD451B which is necessary if vital components are replaced. It is advisable to perform this procedure in the same order as proposed to get optimum results.

Test equipment required

- A high-impedance digital voltmeter.
- An EHT-voltmeter.
- An oscilloscope (dc to at least 100 MHz bandwidth).
- A linearity graticule for setting picture size and linearity.
- A colour analyser, calibrated for the type of phosphors as used in the display. Any other suitable luminance measurement equipment may be used.

Preliminary

Read the Service Safety Precautions at the front of this manual before starting the adjustments.
Check for correct installation of the display with regard to mains voltage and signal connections.
Disconnect the power.
Remove top cover from the display (See Chapter 3 : Maintenance).
Apply power and turn on the display.
All measurements have to be performed after a warming-up period of minimum 30 minutes.
The display must be in calibrated position unless specified otherwise.

Power supply adjustment

The correct adjustment of the potentiometers P1 and P2 on the Switched Mode and EHT Power Supply board [P] is utmost important to obtain correct power supply voltages, correct EHT voltage and limited X-ray radiation.

+ A, + 88.0 V power supply adjustment

- Adjust P1 on the switched mode and EHT power supply board [P] for 88.0 V at Tp1.

+ E, EHT supply adjustment

- Adjust P2 on the switched mode and EHT power supply board [P] for 145.0 V at Tp2.

High voltage adjustment

The EHT and EHT limit voltage potentiometers P3 and P4 available on the switched mode and EHT power supply board P are factory adjusted and sealed.
Readjustment is only possible after replacing both potentiometers.
- Switch off the display.
- Connect a high voltage probe to the EHT connection at the CRT.
- Set P4 (EHT limit) on board [P] in maximum position (turn counterclockwise).
- Switch on the display.
- Apply a full white test pattern and set the display in calibrated position.
- Adjust P3 (EHT adjust) on board [P] for 29 kV reading.
- Adjust P4 (EHT limit) till the EHT is switched off.
- Switch off the display.
- Turn back P3 (EHT adjust).
- Switch on the display.
- Adjust P3 (EHT adjust) for 26 kV.
- Seal P3 and P4.

Automatic selection between scan A and scan B

The selection between scan A and scan B is completely automatic. The parameter on which the selection is based can be selected with switch S2 ("A/B SELEKT") on the H & V deflection board. This switch can be set in 4 different positions:

1. Position 1: scan A/B selection is based on the horizontal frequency of the incoming signal.
2. Position 2: scan A/B selection is based on the vertical frequency of the incoming signal.
3. Position 3: scan A/B selection is based on the vertical sync polarity of the incoming signal.
4. Position 4: scan A/B selection is based on the information available at the remote control connector.

Note: the green led D27 is switched on when scan B is automatically selected. The led is off when scan A is selected.

1) Position '1' parameter: horizontal frequency

If you want to use the **horizontal frequency** as parameter, make sure that there is a minimum difference of 2 kHz between the line frequencies of both signals to ensure a correct operation.
Scan A is automatically selected when a signal is applied with a lower or equal horizontal frequency than the adjusted switching horizontal frequency X. Scan B is selected automatically if the horizontal frequency of the signal is at least 2 kHz higher than the adjusted horizontal frequency X.

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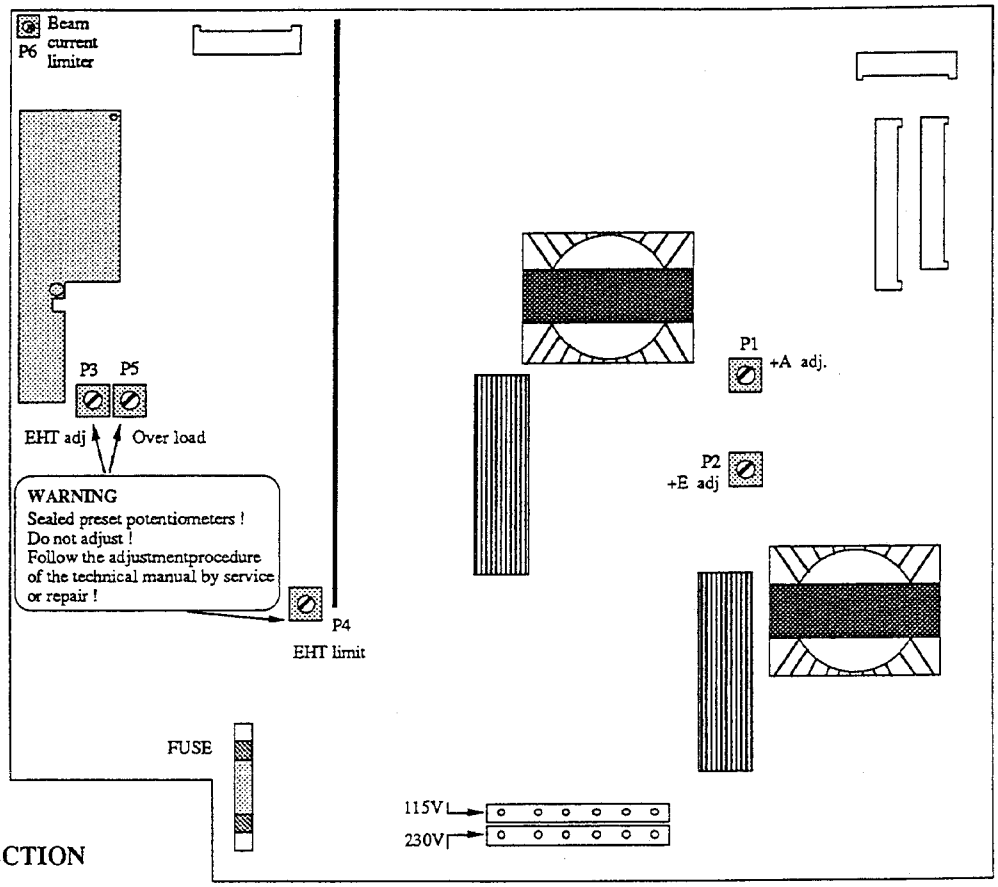
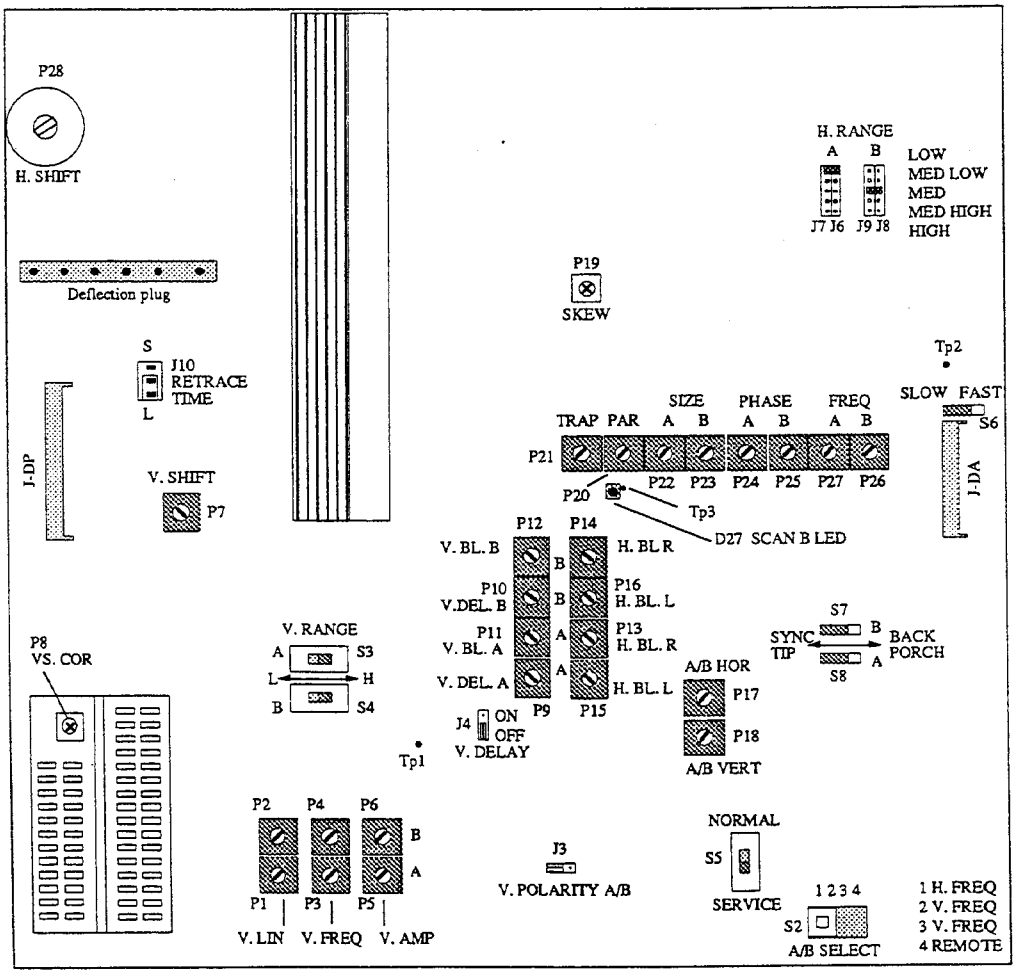
SWITCHED MODE POWER SUPPLY



DEFLECTION



Horizontal switching frequency adjustment

- Apply the signal with the lowest horizontal frequency
- Set switch S2 ("A/B SELEKT") in the most left position ('1' position)
- Set switch S5 in the 'lower' position ("SERVICE" position)
- Adjust P17 till the green led D27 switches off.
- Now set switch S5 in the 'upper' position ("NORMAL" position)

2) Position '2' parameter: vertical frequency

If you want to use the **vertical frequency** as parameter, make sure that there is a minimum difference of 5 Hz between the field frequencies of both signals to ensure a correct operation.
Scan A is automatically selected when a signal is applied with a lower or equal vertical frequency than the adjusted switching vertical frequency X. Scan B is selected automatically if the vertical frequency is at least 5 Hz higher than the adjusted vertical frequency X.

Vertical switching frequency adjustment

- Apply the signal with the lowest vertical frequency.
- Set switch S2 ("A/B SELEKT") in the second position ('2' position).
- Set switch S5 in the 'lower' position ('SERVICE' position).
- Adjust P18 till the green led D27 switches off.
- Now set switch S5 in the 'upper' position ("NORMAL" position).

3) Position '3' parameter: vertical sync polarity

The logic used is represented in following table:

Polarity vertical sync input signal	J3	Selected scan
positive	low	A
negative	low	B
positive	high	B
negative	high	A

4) Position '4' Remote

The selection of scan A or B depends on the information at the 9 pin remote control connector:

- RS232 data on pin 3 (see Interconnection Protocol manual)
- Via an external switch connected between pin 4 and 7 (earth) of the remote control connector.
  Scan B is selected when pin 4 is connected with pin 7.

Horizontal frequency setting

The horizontal frequency setting consists of three major steps:

- separate horizontal scan range setting for scan A and scan B.
- scan A horizontal frequency adjustment.
- scan B horizontal frequency adjustment.

Horizontal scan range setting for scan A and scan B

The horizontal frequency range for each scanning (A and B) is variable between 15 and 36 kHz. This range is divided into five parts which can be selected with jumper J6-J7 (RANGE A) and jumper J9-J8 (RANGE B) on the H & V deflection board [D] .

RANGE	min freq. (kHz)	max freq. (kHz)	position jumpers J6-J7 & J9-J8
low	15	17.9	1
medium low	17.9	21.3	2
medium	21.3	25.4	3
medium high	25.4	30.2	4
high	30.2	36	5

Compare your signal specifications for both scannings and select the appropriate position for jumpers J6-J7 (SCAN A) and J8-J9 (SCAN B).
Note : remember that scan A is always set for the lowest frequency.

Scan A Horizontal frequency adjustment.

- Make sure that the correct horizontal scan range is selected with J6-J7.
- Apply the correct signal.
- Connect the power cord and switch on the display.
- LED D27 on the deflectionboard must be off (scan A selected)
- Short circuit Tp2 on the deflection board to earth and adjust P27 (FREQ A) for a picture as stable as possible.
- Remove the short circuit.

Note : if no picture is visible on the screen, refer to the leds on the front panel. It may be absence of synchronization signal.

Scan B Horizontal frequency adjustment.

- Make sure that the correct horizontal scan range is selected with J9-J8.
- Apply the correct signal.

- Led D27 on the deflection board must light up (scan B selected).
- Short-circuit Tp2 on the deflection board to earth and adjust P26 (FREQ B) for a picture as stable as possible.
- Remove the short-circuit.

Vertical frequency adjustment

The vertical frequency adjustment consists of three major steps:

- separate vertical scan range setting for scan A and scan B.
- scan A vertical frequency adjustment.
- scan B vertical frequency adjustment.

Vertical scan range setting for scan A and scan B.

The vertical frequency range for each scanning (A and B) is variable between 45 and 80 Hz. This range is divided into two parts which can be selected with switch S3 (RANGE A) and S4 (RANGE B) on the H & V Deflection board.

RANGE	min freq. (Hz)	max freq. (Hz)	position S3 and S4
low	45	65	L
high	65	80	H

Scan A vertical frequency adjustment

- Make sure that the correct field scan range is selected with switch S3.
- Apply the correct signal source.
- Short-circuit Tp1 to earth.
- Adjust P3 ('V.FREQ A') to obtain an upwards vertical beat on the screen of approximately 3 times per second.
- Remove the short-circuit.

Scan B vertical frequency adjustment

- Make sure that the correct field scan range is selected with switch S4.
- Apply the correct signal source.
- Short-circuit Tp1 to earth.
- Led D27 on the deflection board must light up (scan B selected).
- Adjust P4 ('V.FREQ B') to obtain an upwards vertical beat on the screen of approximately 3 times per second.
- Remove the short-circuit.

Horizontal flyback time selection

With J10 on the deflection board [D] , two different flyback times can be selected. Jumper J10 can be set in an 'upper' position which causes short (S) horizontal flyback pulses and in a 'lower' position which causes long (L) horizontal flyback pulses.
For reliability reason long flyback pulses are recommended (when possible).
Note : The long horizontal flyback pulse setting can only be used when the total time (HFD +HS + HBP) is greater than the horizontal flyback time.

Focus adjustment

- Apply a convergence test pattern.
- Adjust P2 on the CRT socket board [T] till an optimal focus over the entire screen is obtained.

Fast/slow sync setting

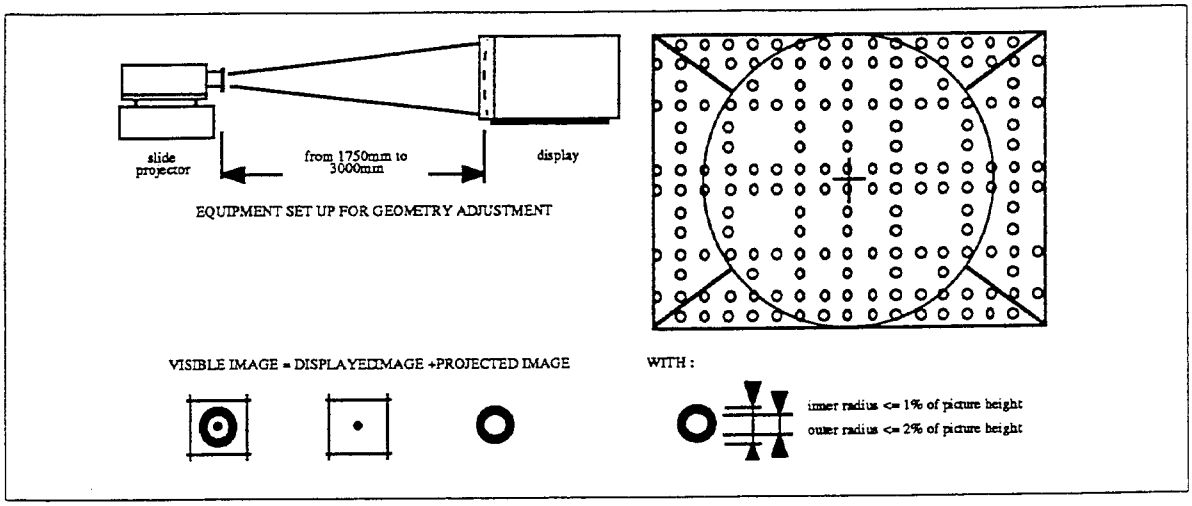
The fast/slow sync setting is realised with S6 on the deflection board [D] . Normally S6 is set in the 'slow' position. In case a bended or unstable picture on top of the screen is visible, select 'fast' position.

Backporch and synctip clamping

The backporch/synctip clamping selection is realized with S8 for scan A and with switch S7 for scan B. Normally backporch clamping is selected. Synctip clamping is selected when the hor. backporch is smaller than 1.6µS. Note that in this mode only non-composite video signals can be used so that external sync is mandatory.

Geometry adjustment

The setting of the picture geometry has been done with the aid of the projection of a slide. It is suggested that this method of adjusting geometry is followed in order to obtain the right specifications.
Before starting the geometry adjustment, ensure the whole display is demagnetized.
Apply a cross hatch/dot pattern.
Following figures will show you the installation of the display with the slide projector and a linearity graticule and a survey of possible geometry corrections.
Note that the used slide must correspond to the test signal pattern displayed on the screen.


slide projector
from 1750mm to 3000mm
display
EQUIPMENT SET UP FOR GEOMETRY ADJUSTMENT
VISIBLE IMAGE = DISPLAYEDIMAGE +PROJECTED IMAGE
WITH :
inner radius <= 1% of picture height
outer radius <= 2% of picture height

COMMON ADJUSTMENTS FOR SCAN A AND B ON THE DEFLECTION BOARD:

In the vertical direction:

- Vertical sync delay and vertical shift adjustment

Set jumper J4 (V. Delay) on board [D] in ON position.
Apply the signal with the shortest vertical blanking and set its corresponding potentiometer P10 (SCAN B) or P9 (SCAN A) in minimum position.
Adjust P7 (V.Shift) on board [D] so that the scanning is vertically in the middle of the screen.
Apply the signal with the longest vertical blanking and adjust the scanning in the middle of the screen by means of its appropriate delay potentiometer P10 or P9.
Note : If you loose information at the top of your picture then readjust the vertical blanking.

- Vertical S correction

Adjust P8 (VS.COR) on board [D] for equal distances between the horizontal lines.

In the horizontal direction:

- Horizontal shift

Adjust P28 on board [D] so that the scanning is horizontally in the middle of the screen.
Note: If you loose information at the left side then readjust the horizontal blanking.

- Skewing

Adjust P19 on board [D] to have correct vertical lines.

- Trapezium correction

Adjust P21 on board [D] to have equal horizontal amplitude at top and bottom.

- Parabola correction

Adjust P20 on board [D] to have straight vertical lines at left side and right side.

- Horizontal linearity

Adjust L5 on board [D] for equal horizontal distances between vertical lines left side and right side.

SEPARATED ADJUSTMENTS FOR SCAN A AND B ON THE DEFLECTION BOARD:

In the horizontal direction:

- Horizontal amplitude

Adjusted with P22 for scan A on board [D] .
Adjusted with P23 for scan B on board [D] .
Adjust the appropriate potentiometer for each scanning for a picture width of 360mm (4/3 aspect ratio).

- Horizontal blanking left

Adjusted with P15 for scan A on board [D] .
Adjusted with P16 for scan B on board [D] .
Adjust the appropriate potentiometer for each scanning until the utmost left side of your picture is fully displayed.

- Horizontal blanking right

Adjusted with P13 for scan A on board [D] .
Adjusted with P14 for scan B on board [D] .
Adjust the appropriate potentiometer for each scanning until the utmost right side of your picture is fully displayed.

- Horizontal phase

Adjusted with P24 for scan A on board [D] .
Adjusted with P25 for scan B on board [D] .

Adjust the appropriate potentiometer for a correct phase, so that no picture content is lost (picture content centered in the picture scan).

In the vertical direction:

- *Vertical amplitude*

Adjusted with P5 for scan A on board [D] .
Adjusted with P6 for scan B on board [D] .
Adjust the appropriate potentiometer for each scanning until a picture height is obtained of 270mm (4/3 aspect ratio).

- *Vertical blanking*

Adjusted with P11 for scan A on board [D] .
Adjusted with P12 for scan B on board [D] .
Adjust the appropriate potentiometer for each scanning until the top of your picture is fully displayed.

- *Vertical linearity*

Adjusted with P1 for scan A on board [D] .
Adjusted with P2 for scan B on board [D] .
Adjust the appropriate potentiometer for each scanning for equal distances between the horizontal lines at top and bottom.

Tracking

- Apply no video signal.
- Use a high impedance DC voltmeter, with at least 4 digits. Connect the negative lead of the voltmeter to the cathode of D406, marked "- 5 V" on the [A] board.
- Connect the positive lead of the voltmeter to Tp101/201/301 on the [A] board and respectively adjust with P101/201/301 for 2.550 V ± 5 mV.

Bias adjustment

- Apply no video signal.
- Connect a low capacitance probe (2pF) to Tp102/202/303 on the [A] board.
- Adjust P105/205/305 on the [A] board for a DC voltage of 70 V ± 0.5 V.

Light output adjustment

The light output adjustment consists respectively of following adjustments:

- VG2 adjustment

- Be sure that the metal plate to the back of the RGB IN/OUT board [A] is installed.
- Apply a 10 % video signal.
- Adjust the lowlight presets P107 (red), P207 (green), P307 (blue) available on board [A] for a horizontal backporch DC level of 120 V at the red (Tp1), green (Tp2) and blue (Tp3) output available at the CRT socket board [T] (earth = Tp5)
- Install a colour analyser calibrated for the type of phosphors used in this display and for a colour temperature according to your system (or use another suitable luminance measurement instrument).
- Adjust the VG2 voltage by means of P1 available on board [T] for a light output of 0.7 Nit for the colour channel with the highest light output.

- Lowlight adjustment

- Adjust the lowlight values of all colour channels via the potentiometers P107 (red), P207 (green), P307 (blue) on board [A] for a light output of 0.7 Nit.

Note : 1 Nit = 1 candela/square meter = 0.292 footlambert (fL)
1 footlambert = 3.43 Nit = 3.43 candela/square meter.

- Highlight adjustment

- Apply a full white test pattern (100 %).
- Adjust the highlight values via the gain preset potentiometers P104 (red), P204 (green), P304 (blue) on board [A] for a light output of 60 Nit (50 Nit for LP).

Repeat this low and highlight adjustment till stable values are obtained.

- Beam current limit

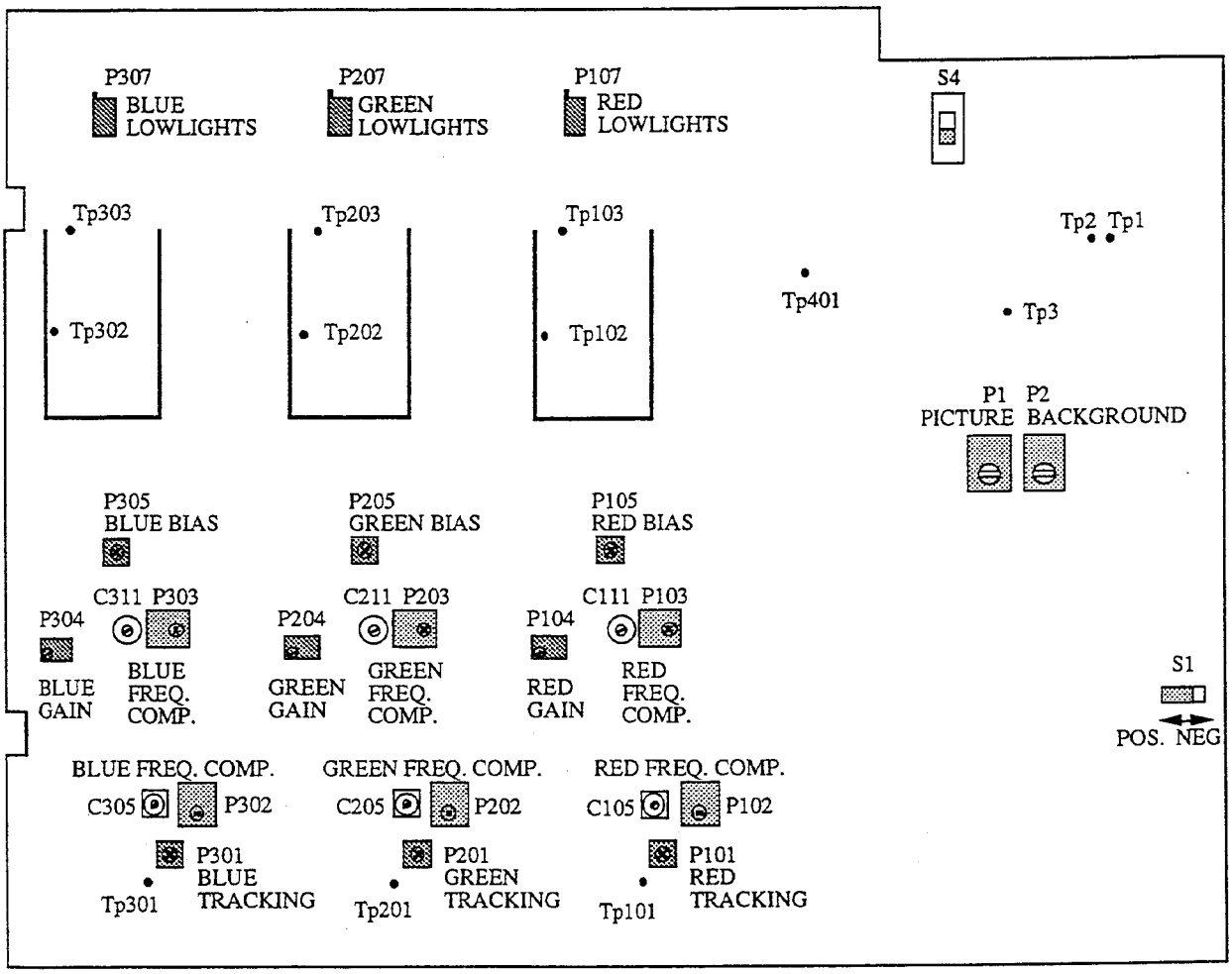
- Set picture and background available on the front control panel in maximum position.
- Adjust P6 available on the switched mode and EHT power supply board [P] for a light output of 130 Nit (110 Nit for LP).

Note : Do not touch the 'overload adjustment' P5 on the [P] board. P5 is factory adjusted.

Frequency response

- Apply a video sweep signal (0 ... 100 MHz).
- Connect a 2 pF low capacitance probe of an oscilloscope to the red (Tp1), green (Tp2) and blue (Tp3) output available at the CRT socket [T] .
- Turn P102/202/302, C105/205/305 on the RGB IN/OUTPUT board [A] for a highband frequency response as flat as possible.
- Turn P103/203/303 and C111/211/311 on the RGB IN/OUTPUT board [A] for a lowband frequency response as flat as possible.

RGB INPUT / OUTPUT AMPLIFIER & REMOTE CONTROL



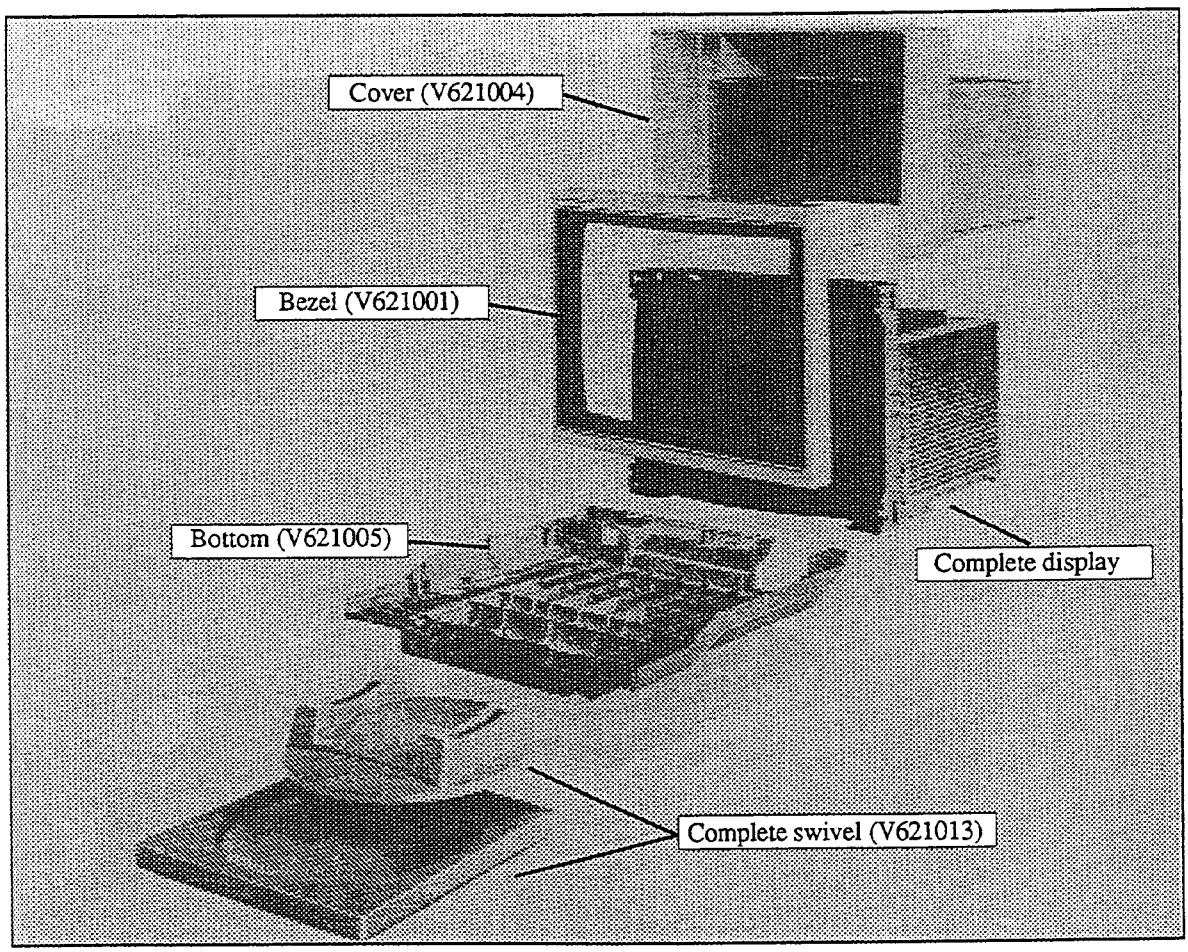
MC-Service

CHAPTER 5 : MISCELLANEOUS INFORMATION

GENERAL :

In this chapter we will give some information about order numbers for parts which are not part of a board. In a second section, pinnings and blockdiagrams are given to understand better the circuit descriptions

OUTSIDE HARDWARE PARTS :



NOTE : The swivel is composed of different parts but is delevered as a single unit (V621013). Only the washers to mount the swivel to the display are separately available (V621012). Order numbers given in the photo above are typical for the hardware parts in Barco colour. If your display is a OEM type with an other colour, please use the following table to order the correct spare parts.

MECHANICAL PARTS

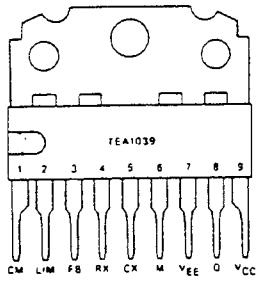
ORDER NUMBER	QUANTITY	DESCRIPTION
C302127	2	CORE 8,0X 4,0X18,0
C312000	1	SPRING FE D 50X0,60
C313614	2	CON HOUSE DEFL P 6
C313615	8	CON FOW TE 2,36 P 1
C348070	3	CABLECLIPS D9,53
C3490111	1	WIRE UN LV 22 1015 50 00
C660193	1	UN AQUADAG CD 351 01
V3132642	1	CON MOC MAINS FF 6A
V3133451	2	PCB EDGE HOLD 6,0
V3133454	5	PCB EDGE HOLD 12,0
V3133461	2	PCB SUPPORT 6,0
V3133475	2	PCB SPACER 6,4
V324700	1	MAINS SWITCH N 30X W FRAME
V3247001	1	MAINS SWITCH N 30X CLAMP
V3247002	1	MAINS SWITCH N 30X BUTTON
V3261031	1	MAINS CORD 3X0,75 2,0M
V348000	8	CABLE TIE B2,5L 98
V348006	2	CABLE TIE B2,5L140
V3480262	3	EDGING SADDLE EDS-2
V3480265	2	EDGING SADDLE 1717U
V3480602	7	WIRE SADDLE 11X10MM
V348073	2	CABLE CLIPS TWIST
V3490112	1	WIRE UN LV 18 1007 50 00
V3490113	2	WIRE UN LV 18 1007 80 00
V3491363	2	CORD MTIS 220MM 2XP10 00
V3492064	1	CORD MTIS 850MM 2XP15 00
V3493411	1	CORD MTIS 730MM 2XP12 00
V3493451	1	CORD MTIS 730MM 2XP17 00
V349347	2	WIRE UN MAINS 1 7X51 00
V349349	1	WIRE UN MAINS 2 7X51 00
V349354	1	WIRE UN GROUND 7651 01
V349395	2	DEGAUSS CORD CVM
V349412	1	WIRE EARTH L20 CD651 00
V349413	1	DEFLECTION CORD CD651 LA
V3563284	2	FOOT D 20 H 4
V3563288	2	FOOT D 20 H 8
V358136	5	PCB CARD FIXER SNAP
V361913	2	SMC+M M3 X 8 D 965
V3621217	33	SMP*M M3 X 6 TORX
V3621227	8	SMP*M M3 X 8 TORX
V3623197	6	SMH*M M4 X 8 TORX
V3623337	4	SMH*M M5 X12 TORX
V3636037	5	SMP*C 3,5X 6 TORX
V3636087	15	SMP*C 3,9X10 TORX
V3636097	6	SMP*C 3,9X16 TORX
V3636097	2	SMP*C 3,9X16 TORX
V367503	2	WASHER LA 4,3 D67
V590225	1	LABEL CAUTION HIGH
V590230	1	LABEL ACHTUNG ROENTGEN
V591034	1	LABEL DANGER 37X18
V593002	1	BAG 06 1050X1110
V593450	1	BOX 201 680X580X500
V593451	1	PACKING DOWN 7651 00

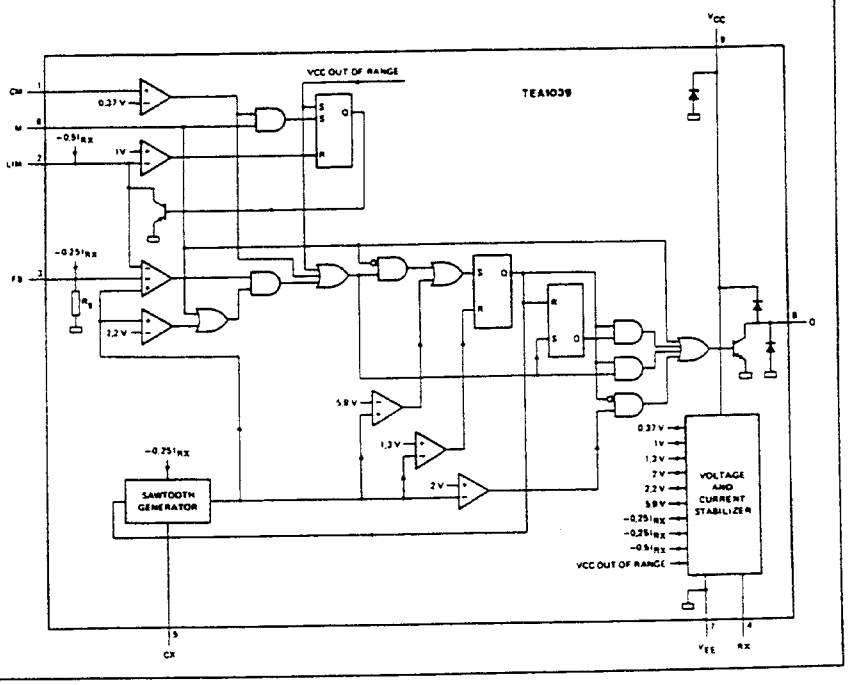
ORDER NUMBER	QUANTITY	DESCRIPTION
V593453	1	BOX ADHESIVE 50X50X50 00
V598454	1	INSTRUCTION NOTE SWIVEL
V6010301	1	FRAME COMPLETE CD651 01
V601039	1	RIGHT SHIELD 7651 00
V601040	1	LEFT SHIELD 7651 00
V601041	1	TOP SHIELD 7651 00
V601044	4	FIX CRT LUGS 7651 01
V601068	1	REAR PLATE CD651 01
V601069	1	PLUGPLATE CD651 01
V601071	1	PACKING UP 7651 01
V6210010	1	BEZEL TREATMENT BARCO 00
V6210040	1	COVER TREATMENT 7651 00
V621005	1	BOTTOM RAL 7037 7651 01
V621013	1	SWIVEL COMPLETE 7651 01
V670023	2	DEGAUSS COIL 20" 00

PINNING AND BLOCKDIAGRAM OF THE INTEGRATED CIRCUITS

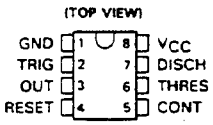
- SWITCHED MODE AND EHT POWER SUPPLY

TEA1039

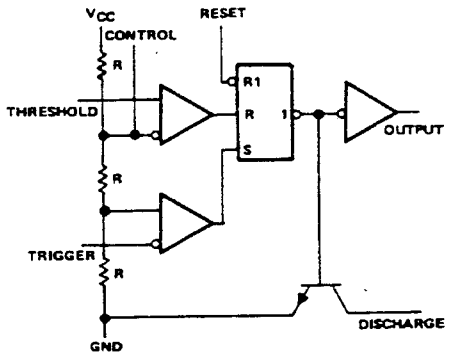




NE555



functional block diagram

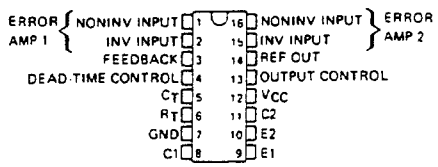


Reset can override Trigger, which can override Threshold.

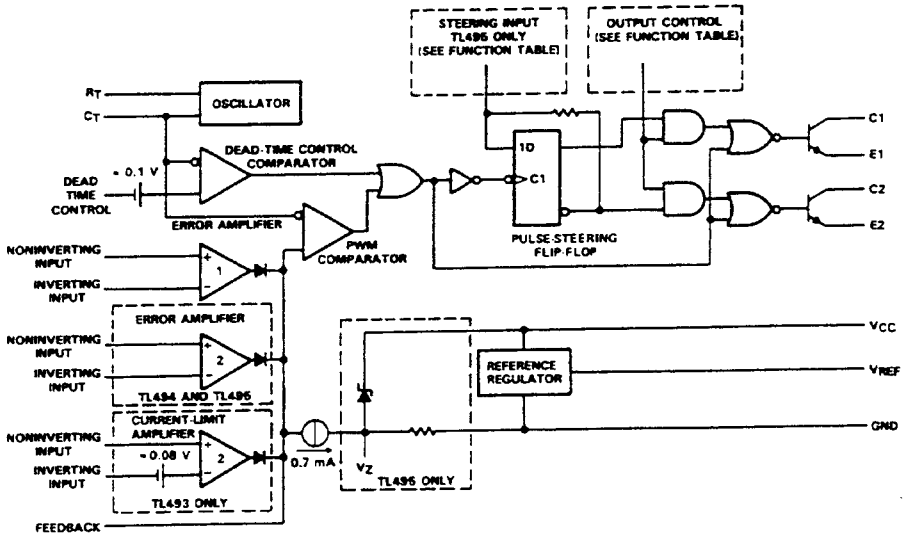
- SWITCHED MODE AND EHT POWER SUPPLY

TL494

DUAL-IN-LINE PACKAGE (TOP VIEW)



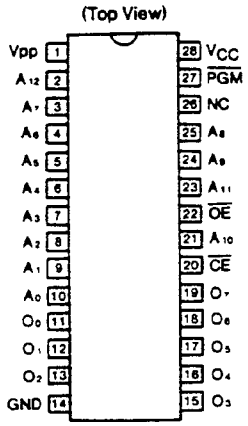
functional block diagram



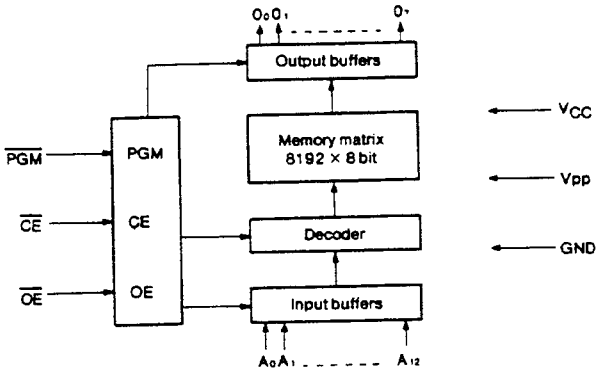
- RGB IN/OUTPUT AND REMOTE CONTROL BOARD

MSM2764A

PIN CONFIGURATION

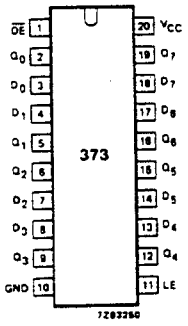


FUNCTIONAL BLOCK DIAGRAM

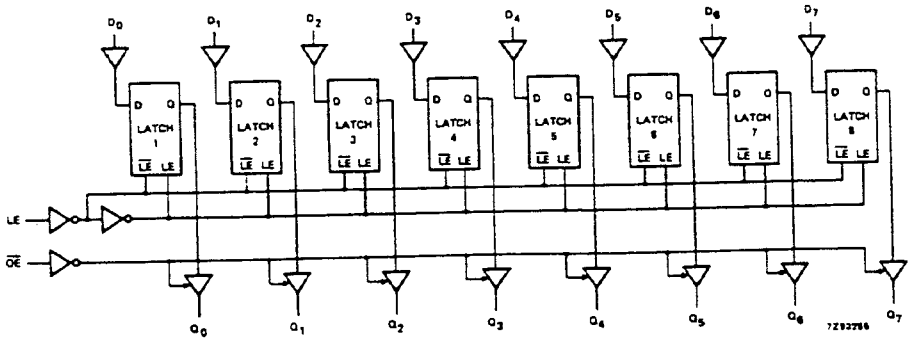


This specification may be changed without notification.

74LS373



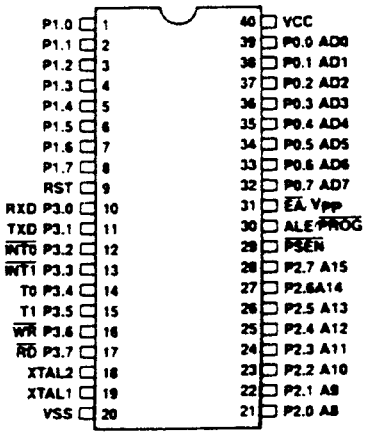
Pin configuration.



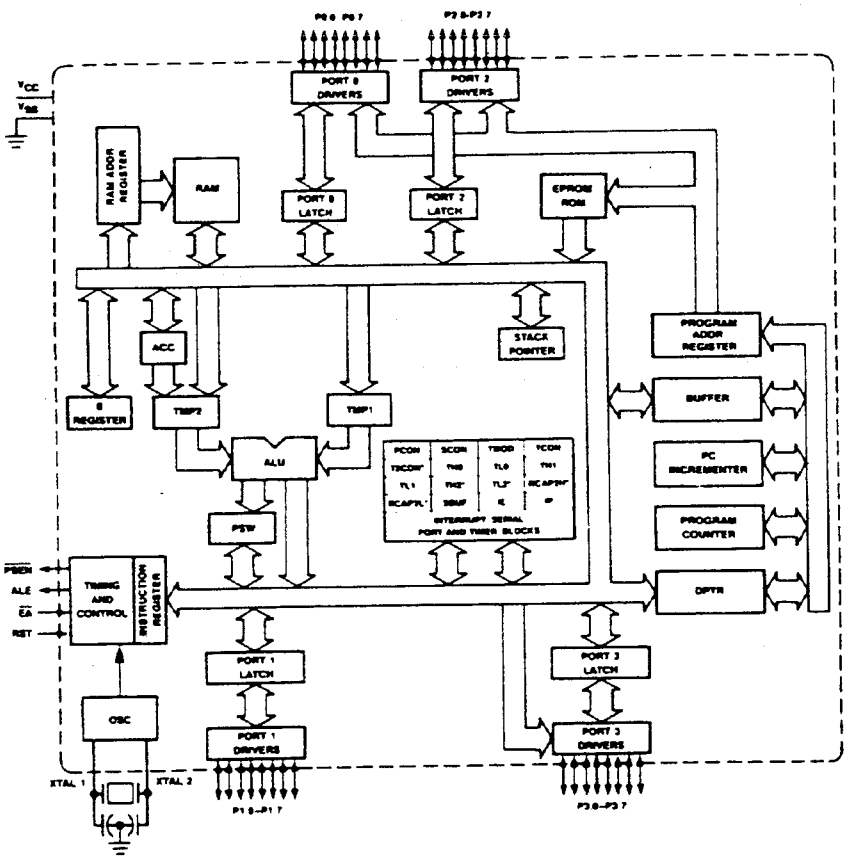
Logic diagram.

- RGB IN/OUTPUT AND REMOTE CONTROL BOARD

8051AHP

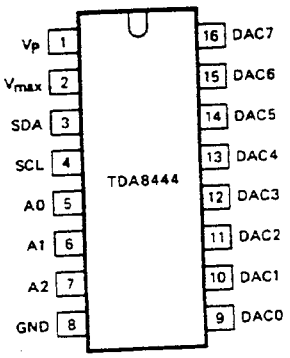


Pin



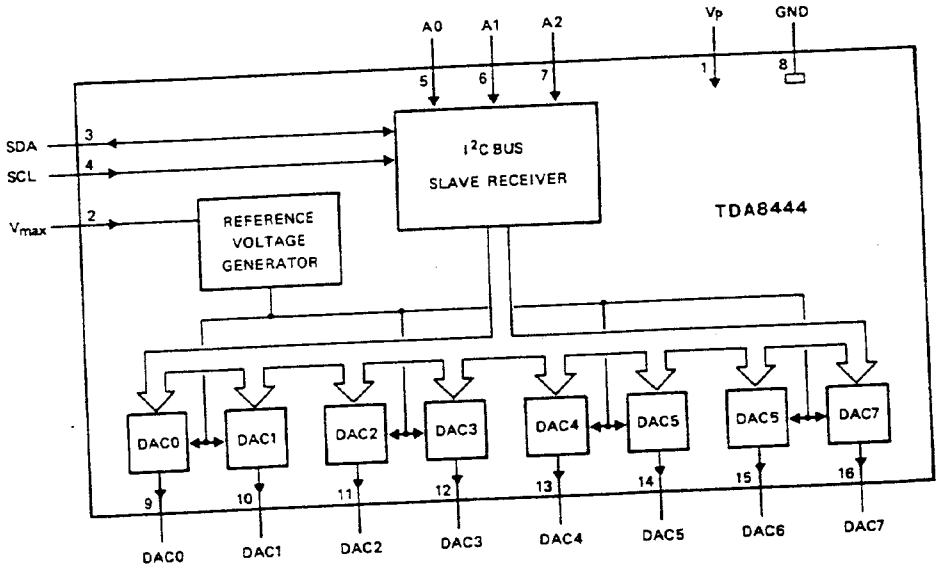
TDA8444

PINNING



1	V_P	positive supply voltage
2	V_{max}	control input for DAC maximum output voltage
3	SDA	I^2C bus serial data input/output
4	SCL	I^2C bus serial data clock
5	A0	programmable address bits for I^2C bus slave receiver
6	A1	
7	A2	
8	GND	ground
9-16	DAC0-7	analogue voltage outputs

Fig. 2 Pinning diagram.

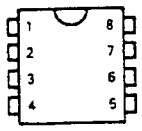


Block diagram.

- H & V DEFLECTION + SYNC BOARD

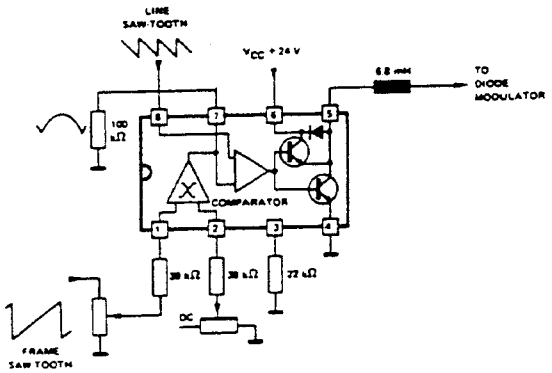
TEA2031A

PIN ASSIGNMENT



1 - Multiplier input 1 (1 and 2 can be inverted)
2 - Multiplier input 2
3 - Current reference
4 - Ground
5 - Output
6 - V_{CC} power supply
7 - Multiplier output and comparator input 1
8 - Comparator input 2

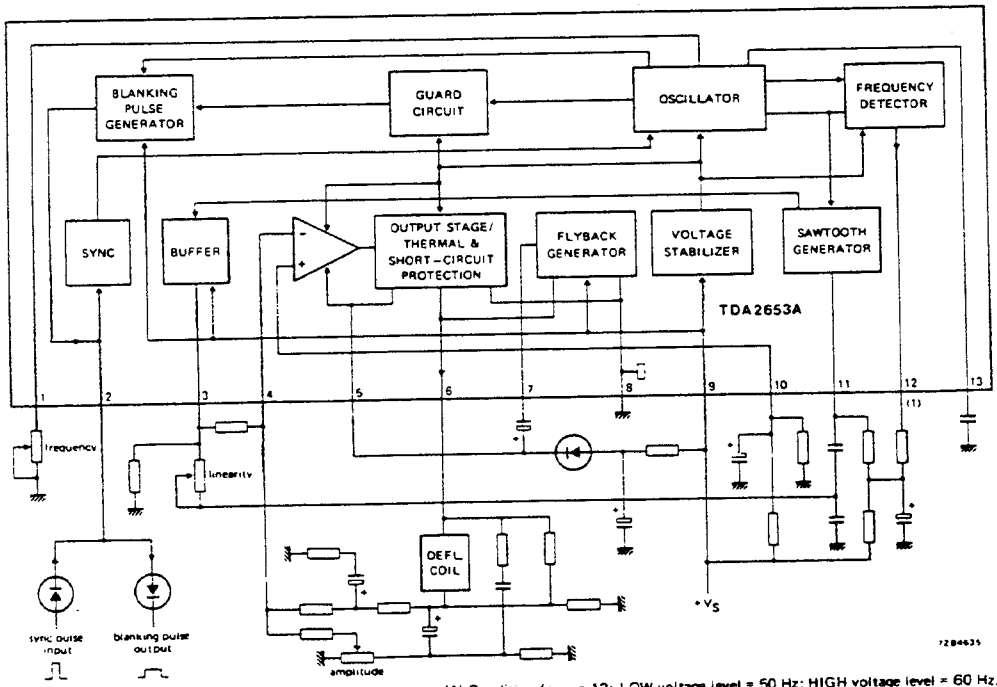
BLOCK DIAGRAM



TDA2653A

PINNING

1. Oscillator adjustment
2. Synchronization input/blanking output
3. Sawtooth generator output
4. Preamplifier input
5. Positive supply of output stage
6. Output
7. Flyback generator output
8. Ground
9. Positive supply (V_S)
10. Reference voltage
11. Sawtooth capacitor
12. 50 Hz/ 60 Hz switching voltage
13. Oscillator capacitor



Block diagram.

(1) Condition for pin 12: LOW voltage level = 50 Hz; HIGH voltage level = 60 Hz.

- H & V DEFLECTION + SYNC BOARD

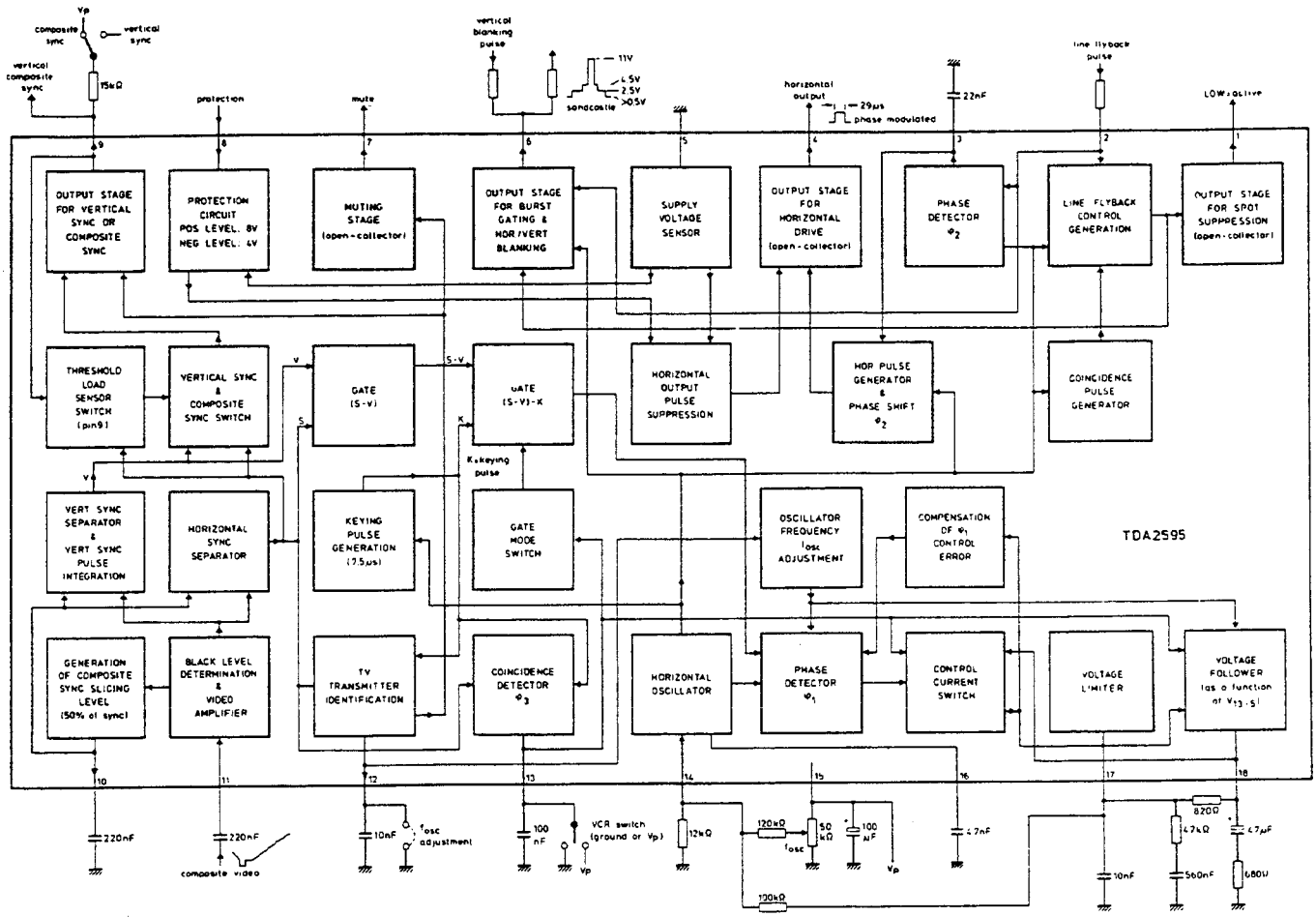
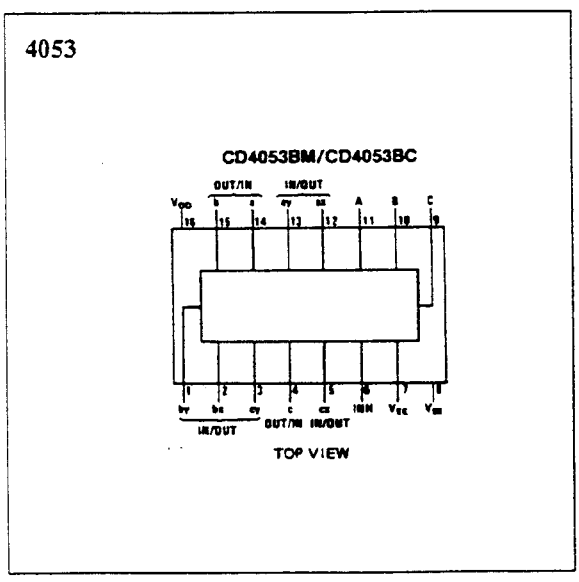
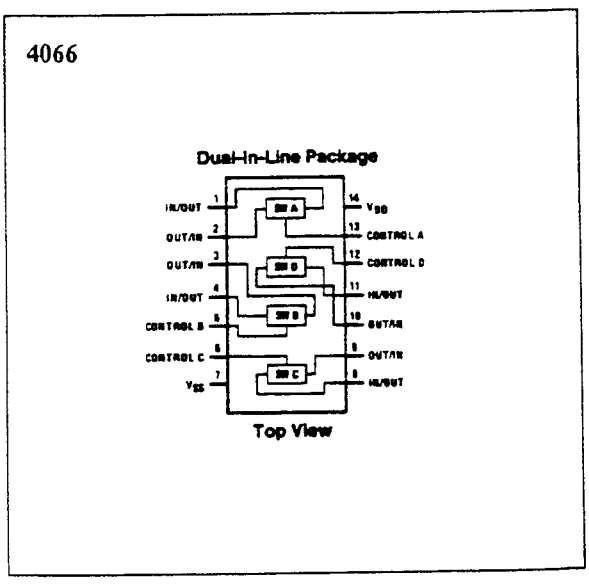


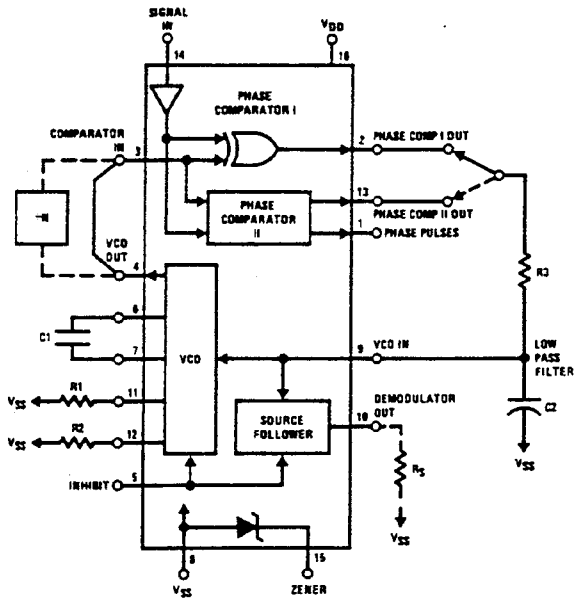
Fig. 1 Block diagram.

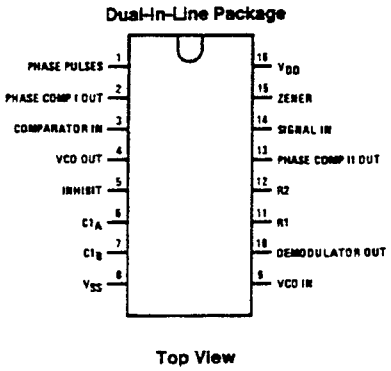




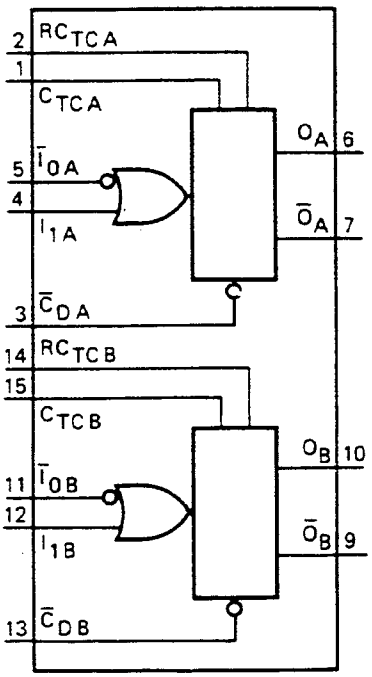
- H & V DEFLECTION + SYNC BOARD

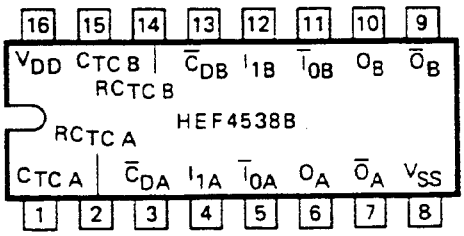
4046





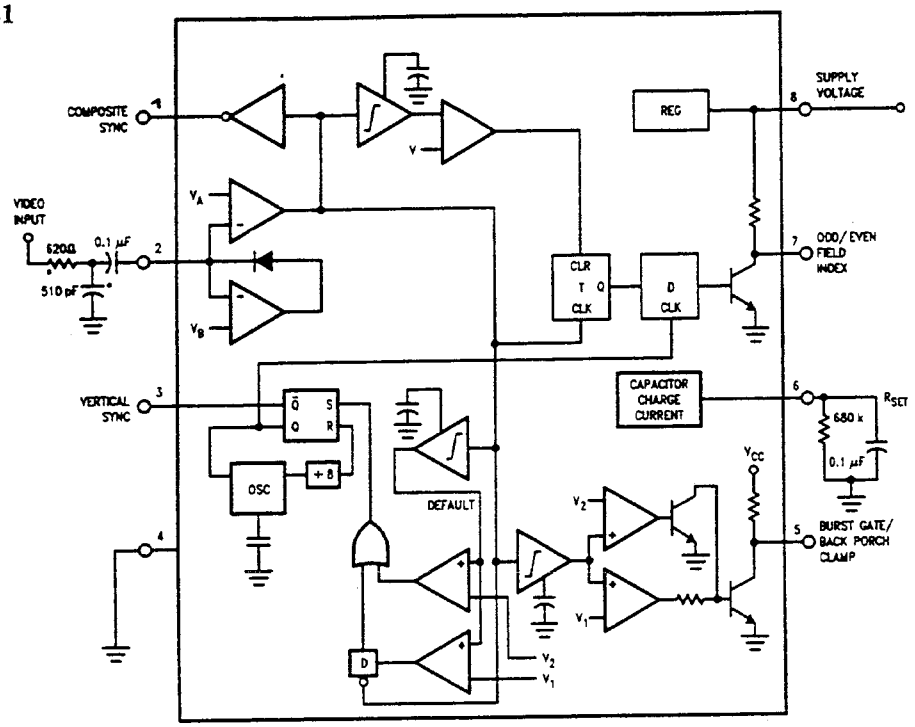
4538





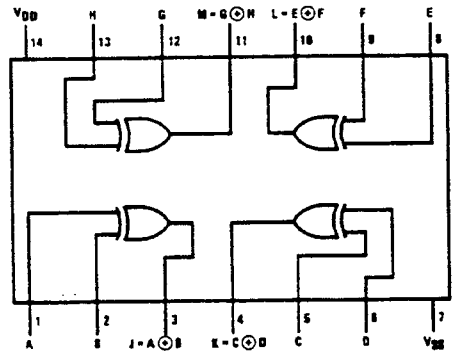
- H & V DEFLECTION + SYNC BOARD

LM1881



4070

Dual-In-Line Package



Top View

Truth Table

Inputs		Outputs
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

ICD 451B

CONNECTORS - definition of pins

MODULE IDENTIFICATION CHARACTERS:

A	RGB IN/OUT AMPLIFIER and REMOTE CONTROL board.
P	SWITCHED MODE and EHT POWER SUPPLY board.
D	H & V DEFLECTION and SYNC board.
O	OPERATION PANEL board.
T	CRT SOCKET
F	DYNAMIC FOCUS (DAF OPTION ONLY)

ABBREVIATIONS:

+ B =	SCANVOLTAGE
+ E =	E.H.T. SUPPLY

NOTATION:
e.g.: J-AO

J: jack
A: source pcb; here: Amplifier
O: destination pcb; here: Operation Panel

1. SWITCHED MODE and EHT POWER SUPPLY board **P**

J-PD	1	+ B
	2	+ B
	3	+ 88 V
	4	NC/TBU
	5	+ 17 V
	6	AGND
	7	- 10 V
	8	AGND
	9	NC
	10	+ 28 V
	11	EHT EN
	12	H PULSE
	13	V PULSE
	14	NC
	15	NC

J-PA	1	+ 160 V
	2	+ 88 V
	3	+ 88 V
	4	NC
	5	AGND
	6	+ 17 V
	7	+ 17 V
	8	AGND
	9	- 10 V
	10	- 10 V
	11	NDEGAUSS
	12	BCL
	13	NC
	14	- 120 to - 190 V
	15	NC
	16	AGND
	17	+ 7 V

J-PT	1	- 120 to - 190 V
	2	NC
	3	SPOTCTRL
	4	SPARE
	5	+ 160 V
	6	SPARE
	7	SPARE
	8	FILHI
	9	AGND
	10	+ 16 V (+ 4)

J-PF	1	AGND
	2	AGND
	3	+ 7 V
	4	V PULSE
	5	H PULSE
	6	+ 17 V
	7	+ 17 V
	8	- 10 V
	9	- 10 V

2. H & V DEFLECTION and SYNC board **D**

J-DP	1	NC
	2	NC
	3	V PULSE
	4	H PULSE
	5	EHT EN
	6	+ 28 V
	7	NC
	8	AGND
	9	- 10 V
	10	AGND
	11	+ 17 V
	12	NC/TBD
	13	+ 88 V
	14	+ B
	15	+ B

J-DA	1	COMP BLANKING
	2	CLAMP PULSE
	3	BIAS PULSE
	4	AGND
	5	HOR/COMP SYNC
	6	AGND
	7	V SYNC
	8	NC
	9	SPARE
	10	EHT EN

3. RGB IN/OUT AMPLIFIER and REMOTE CONTROL board A

J-AP	1	+ 7 V
	2	AGND
	3	NC
	4	- 120 TO - 190 V
	5	NC
	6	BCL
	7	DEGAUSS
	8	- 10 V
	9	- 10 V

	10	AGND
	11	+ 17 V
	12	+ 17 V
	13	AGND
	14	NC
	15	+ 88 V
	16	+ 88 V
	17	+ 160 V
J-AD	1	EHT EN
	2	SPARE
	3	NC
	4	VERT SYNC
	5	AGND
	6	HOR/COMP SYNC
	7	AGND
	8	BIAS PULSE
	9	CLAMP PULSE
	10	COMP BLANK
J-AO	1	MECH GND
	2	NC
	3	AGND
	4	+ 5 V
	5	LED READY
	6	LED PICTURE
	7	LED BACKGROUND
	8	INT DEGAUSS
	9	PICTURE DOWN
	10	PICTURE UP
	11	BACKGROUND DOWN
	12	BACKGROUND UP

4. OPERATION PANEL board O

J-OA	1	BACKGROUND UP
	2	BACKGROUND DOWN
	3	PICTURE UP
	4	PICTURE DOWN
	5	DEGAUSS
	6	LED BACKGROUND
	7	LED PICTURE
	8	LED READY
	9	+ 5 V
	10	AGND
	11	NC
	12	MECH GND

5 CRT SOCKET T

J-TP	1	+ 16 V (+ 4)
	2	AGND
	3	FILHI
	4	SPARE
	5	SPARE
	6	+ 160 V
	7	SPARE
	8	SPOTCTRL
	9	NC
	10	- 120 to - 190 V

Addendum

RGB IN- / OUTPUT	V5629420
CRT SOCKET	V5628972

PARTS LIST OF THE RGB INPUT OUTPUT BOARD
Order number of a complete board : V5629420

Order number	Description	Item
V1011008	R CFFH 1E J 0W25	R401,R402
C1011049	R CFFH 2E2 J 0W25	R172,R272,R372
C1011129	R CFFH 10E J 0W25	R146,R147,R160,R161,R246,R247, R260,R261,R346,R347,R360,R361, R411,R412
V101208	R MF H 4E7 J 0W5	R178,R278,R378
V101210	R MF H 6E8 J 0W5	R130,R230,R330
V101211	R MF H 8E2 J 0W5	R179,R279,R379
V101212	R MF H 10E J 0W5	R114,R120,R123,R131,R132,R133, R134,R170,R174,R214,R220,R223, R231,R232,R233,R234,R270,R274, R314,R320,R323,R331,R332,R333, R334,R370,R374
V101216	R MF H 22E J 0W5	R115,R129,R21 ,R215,R229,R315, R329
V101218	R MF H 33E J 0W5	R142,R175,R242,R275,R342,R375, R424,R425
V101219	R MF H 39E J 0W5	R176,R276,R376
V101220	R MF H 47E J 0W5	R106,R108,R112,R118,R122,R206, R208,R212,R218,R222,R306,R308, R312,R318,R322,R416
V101221	R MF H 56E J 0W5	R105
V101222	R MF H 68E J 0W5	R116,R205,R216,R316
V101224	R MF H100E J 0W5	R125,R167,R181,R225,R25 ,R26 , R267,R27 ,R281,R325,R35 ,R367, R381,R428
V101226	R MF H150E J 0W5	R137,R150,R237,R250,R337,R350
V101228	R MF H220E J 0W5	R20
V101232	R MF H470E J 0W5	R135,R143,R235,R243,R283,R335, R343
V101235	R MF H820E J 0W5	R19
V101236	R MF H 1K J 0W5	R107,R113,R119,R12 ,R124,R126, R141,R162,R207,R213,R219,R224, R226,R24 ,R241,R262,R282,R307, R313,R319,R324,R326,R341,R362, R38 ,R39 ,R40 ,R41 ,R417,R42
V101237	R MF H 1K2 J 0W5	R422
V101238	R MF H 1K5 J 0W5	R33
V101239	R MF H 1K8 J 0W5	R429
V101240	R MF H 2K2 J 0W5	R149,R153,R166,R249,R253,R266, R349,R353,R366,R421
V101242	R MF H 3K3 J 0W5	R23 ,R34
V101243	R MF H 3K9 J 0W5	R28 ,R29 ,R30 ,R31 ,R32
V101244	R MF H 4K7 J 0W5	R103,R110,R177,R18 ,R203,R210, R277,R303,R310,R377
V101245	R MF H 5K6 J 0W5	R154,R155,R254,R255,R354,R355
V101246	R MF H 6K8 J 0W5	R139,R140,R239,R240,R339,R340
V101248	R MF H 10K J 0W5	R104,R138,R14 ,R171,R186,R204, R238,R271,R286,R304,R338,R36 , R37 ,R371,R386,R4 ,R404,R418, R419,R5 ,R6 ,R8
V101249	R MF H 12K J 0W5	R2
V101251	R MF H 18K J 0W5	R17
V101252	R MF H 22K J 0W5	R403
V101253	R MF H 27K J 0W5	R102,R202,R302
V101256	R MF H 47K J 0W5	R13 ,R144,R145,R157,R158,R163, R244,R245,R257,R258,R263,R344, R345,R357,R358,R363
V101258	R MF H 68K J 0W5	R152,R252,R352
V101259	R MF H 82K J 0W5	R151,R251,R351

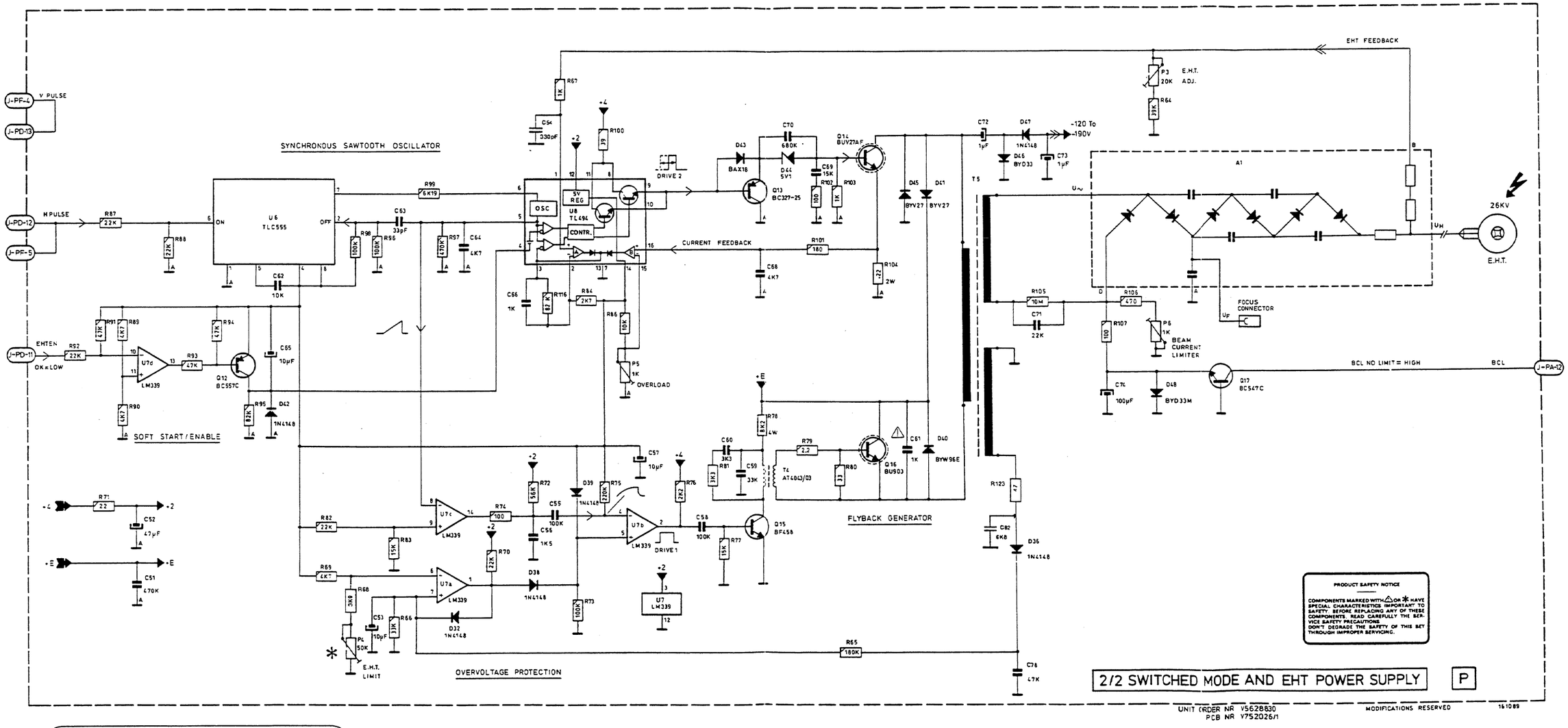
Order number	Description	Item
V101260	R MF H100K J 0W5	R156,R168,R169,R256,R268,R269, R356,R368,R369,R423,R426
V101268	R MF H470K J 0W5	R420
V101272	R MF H 1M J 0W5	R10 ,R3 ,R7 ,R9
V101273	R MF H 1M2 J 0W5	R11
V101280	R MF H 4M7 J 0W5	R148,R165,R248,R265,R348,R365
V1015231	R MF H 75E F 0W4 E3	R101,R15 ,R16 ,R201,R301,R305
V101536	R MF H 1K F 0W4 E3	R430
V1026007	R MF H 10K F 0W6 E4	R407,R413,R414
V1026117	R MF H 13K F 0W6 E4	R408
V1026147	R MF H 14K F 0W6 E4	R415
V1026206	R MF H 1K62F 0W6 E4	R136,R236,R336
V1026227	R MF H 16K9 F 0W6 E4	R406
V1026266	R MF H 1K87F 0W6 E4	R164,R264,R364
V1026278	R MF H191K F 0W6 E4	R159,R259,R359
V1026335	R MF H221E F 0W6 E4	R109,R209,R309
V1026377	R MF H 24K3 F 0W6 E4	R409
V1026516	R MF H 3K40F 0W6 E4	R117,R217,R317
V1026676	R MF H 4K99F 0W6 E4	R1
V1026685	R MF H511E F 0W6 E4	R111,R211,R311
V1026866	R MF H 7K87F 0W6 E4	R405
C102944	R MF H 4K7 J 2W E7	R427
V103438	R MO H 1K5 J 6W	R127,R128,R227,R228,R327,R328
V1061024	R TCE H220E M 0W5 R10NC	P102,P103,P202,P203,P302,P303
V107004	R TCE H200E M 0W5 S7 TS	P101,P201,P301
V107009	R TCE H 10K M 0W5 S7 TS	P105,P205,P305
V107258	R TCA 10K M 0W4 AR12	P1 ,P2
V1075223	R MCE V200E K 0W5 M7 TS	P104,P204,P304
V1075301	R MCE V 50K K 0W5 M10SS	P107,P207,P307
C1113889	C EL RA 47M M100E2 85	C130,C230,C330
V1114149	C EL RA 1M M160E2 85	C414
V1114155	C EL RA 10M M160E2 105	C117,C147,C217,C247,C317,C347
C111467	C EL RA 220M M 16E2 105	C113,C213,C313,C313
V111474	C EL RA 1M M400E2 105	C131,C231,C331,C414,C415
V111477	C EL RA 100M M 25E2 85	C422
V1114855	C EL RA 22M M 50E2 85	C418,C420
V1115109	C EL RA 22M M 25E2 105	C109,C121,C129,C134,C145,C18 , C209,C221,C229,C234,C245,C309, C321,C329,C334,C345
V1115119	C EL RA 47M M 25E2 105	C405,C406,C5
V1115319	C EL RA 10M M 50E2 105	C16 ,C19 ,C4 ,C421
V1115469	C EL RA 1M M 50E2 105	C1 ,C2
V1115509	C EL RA 4M7M 63E2 105	C107,C207,C307
V111679	C EL BRA 10M M 25E2 85	C8
V111681	C EL BRA 22M M 25E2 85	C101,C201,C301
V112231	C NP0 MI 12P G100E2	C146,C246,C346
V112236	C NP0 MI 33P G100E2	C140,C240,C340,C6 ,C7
V112241	C NP0 MI 82P G100E2	C115,C215,C315
V112242	C NP0 MI 100P G100E2	C3
V112362	C N750MI 100P G100E2	C411
V112366	C N750MI 220P G100E2	C144,C244,C344
V112739	C CE MI 1N K100E2	C126,C136,C142,C226,C236,C242, C326,C336,C342,C410
V1127510	C X7R MU 10N K 50E2 125	C124,C224,C324
C112763	C CE MI 10N U 63E2	C106,C108,C110,C114,C206,C208, C210,C214,C306,C308,C310,C314
V1127760	C X7R MU 220N M100E2 125	C118,C141,C150,C218,C241,C250, C318,C341,C350

Order number	Description	Item
V1127830	C X7R MU 100N K 50E2 125	C10 ,C104,C11 ,C119,C12 ,C120, C122,C125,C127,C128,C13 ,C132, C133,C137,C138,C139,C14 ,C15 , C20 ,C204,C21 ,C219,C220,C222, C225,C227,C228,C232,C233,C237, C238,C239,C304,C319,C320,C322, C325,C327,C328,C332,C333,C337, C338,C339,C401,C402,C403,C404, C407,C408,C409,C412,C417,C419
V1127890	C X7R MU 470N K 50E2 125	C116,C216,C316
V1127930	C X7R MU 1M K 50E2 125	C413,C413
C112827	C CE DI 1N5S400E3	C416
V114080	C POMERA 10N K 63E2 100	C135,C235,C335
V114082	C POMERA 22N K 63E2 100	C123,C223,C323
V114088	C POMERA 100N K 63E2 100	C103,C17 ,C203,C303
V114090	C POMERA 220N K 63E2 100	C112,C212,C312
V114096	C POMERA 1M K 50E2 100	C9
V117009	C TH 1.8-22P 100	C105,C205,C305
V117024	C TH 4 -40P 100	C111,C211,C311
V1314073	Q BC547C N SS TO92	Q3
V131411	Q BC549C N SS TO92	Q110,Q118,Q210,Q218,Q310,Q318, Q401,Q402,Q6 ,Q7
V1314133	Q BC557C P SS TO92	Q4 ,Q5
V1314182	Q BC559C P SS TO92	Q102,Q202,Q223,Q302,Q404
V131464	Q BF199 N SS TO92	Q101,Q201,Q301
V1314651	Q BF245B FN SS TO92	Q117,Q121,Q217,Q221,Q317,Q321, Q403
V131494	Q 2N3904 N SS TO92	Q115,Q116,Q215,Q216,Q315,Q316
V1315046	D Y BAT86 050200 DO34	D107,D108,D207,D208,D307,D308
V131620	D Y 1N6263 DO35	D110,D111,D2 ,D210,D211,D310, D311,D402
V1316211	D S 1N4148 075150 DO35	D101,D109,D201,D209,D3 ,D301, D309,D401,D7
V131627	D S BAV21 200250 DO35	D115,D116,D215,D216,D315,D316
V131637	D R BA158 600400 DO7	D104,D105,D204,D205,D304,D305
V131643	D S 1N4151 050150 DO35	D1
V131645	D S 1N4448 075150 DO35	D112,D113,D212,D213,D312,D313
C131646	D R 1N4007 10201A DO41	D405,D406,D6
V131740	D ZEN 12V 0W5 C DO35	D403,D404
V131752	D ZEN 75V 0W5 C DO35	D106,D206,D306
V131756	D ZEN 7V5 0W5 C DO35	D103,D203,D303
V131763	D ZEN 5V1 0W5 B DO35	D5
V132194	U 072 TL DIP8 P	U104,U204,U304,U403
V132504	Q 2N2369A N SS TO18	Q1
V132507	Q BF324 P SS TO92	Q107,Q207,Q307
V132516	Q BF422 N SS TO92	Q119,Q219,Q319
V132520	Q 2SC3599E N P T0126	Q112,Q212,Q312
V132546	Q BFX89 N SS TO72	Q103,Q104,Q105,Q106,Q109,Q203, Q204,Q205,Q206,Q209,Q303,Q304, Q305,Q306,Q309
V132575	Q BC517 DN SS TO92	Q122,Q222,Q322
V132594	Q MRF544 N SS TO39	Q111,Q113,Q211,Q213,Q311,Q313
V132595	Q MRF545 P SS TO39	Q114,Q214,Q314
V132597	Q BFQ63 N SS TO72	Q108,Q208,Q308
V132618	Q BSS101 FN SS TO92	Q120,Q220,Q320,Q406
V132624	Q BSS92 FP SS TO92	Q405
V133005	Q ACC ISO SIL 18X 13	0060
V1330135	Q ACC MNTG PAD TO5	0050
V1330145	Q ACC MNTG PAD TO18	0004
V133043	Q ACC ISO ALOX TO220	0005
V133047	Q ACC HTSNK TO220	0009
V1330515	Q ACC HTSNK TO126	0002
C133054	Q ACC CLIPS SOT93	0006

Order number	Description	Item
V133062	Q ACC HTSNK TO5	0015
V133076	Q ACC MNTG PAD TO5	0003
C134002	U 7812 TO220 P	U401
V134005	U 339 LM DIP14 P	U6
C134011	U 7905 TO220 P	U402
V134018	U 431C TL TO92 P	U101,U201,U301,U404,U405
V134044	U 2940-5 LM TO220 P	U7
V134135	U 34082 MC DIP8 P	U102,U202,U302
V134213	U 77G OP DIP8 P	U105,U205,U305
C137207	U 1489 DIP14 P	U5
V137232	U 8031AH 12MDIP40 P	U1
V137259	U 8444 TDA DIP16 P	U4
C137498	U 74LS373 DIP20 P	U2
C302108	CORE TUBE 3.5/ 1.3 X 3	0021
V306100	CH AX NS 9 UH	L104,L105,L204,L205,L304,L305
V3061443	CH AX S 100 UH	L103,L203,L303
V306800	X ACC INSUL HC49	0014
V306821	X 11.059200 MHZ HC49 30	Y1
V313104	J BNC FBT P 1 50E PC	J10 ,J11 ,J12 ,J13 ,J14 ,J5 , J6 ,J7 ,J8 ,J9
C3132441	J U0.6 FBT P40 E1AU TLP	0017
C3132531	J U0.6 FBT P28 E1AU TLP	0016
C313286	J MD1 C MBT P 3 E1SN 6.7	J17
C3133921	J MD SHUNT E1SN PULL OUT	0070
C313454	J TAB1 MBT H 4.8S0.5	0025
V3135016	J DE P8 FBT P 9 FUMBL	J2
V3137040	J MT MBT P 4 R1 FL BLK	J101,J15 ,J201,J301
V3137090	J MT MBT P 9 R1 FL BLK	J16
V3137100	J MT MBT P10 R1 FL BLK	J4
V3137120	J MT MBT P12 R1 FL BLK	J3
V3137170	J MT MBT P17 R1 FL BLK	J1
V3153111	J RVT MBT D 2 L12	0007
V3153112	J RVT MBT D 2 L22	0008
V324150	SW SLD JSA 2C BT	S101,S2 ,S201,S3 ,S301,S4
V3481004	WU JUMP 0.6 2.54	J18 ,J19 ,0040
C348101	WU JUMP 0.6 5	P106,P206,P306
V3481024	WU JUMP 0.6 7.62	W2
C3482005	SLVU OIL D1.5 RD 5	0027
V3570992	BTN T D 6 BLK	0022
V362122	SCR D7985 M 3 X 8 S Z	0010
V366102	NUT D934 M 3 S Z	0011
V367502	WSHR D6798 A 3.2 S Z	0012
V368548	SPR RVT L10 M3 SSN	0026
V5629415	UN AUT HOR SYNC ICD451B	0030
V5681521	CHIP SET ICD451B	U3
V602950	J TAB1 BT D	TP1 ,TP10,TP11,TP13,TP14,TP2 , TP20,TP21,TP23,TP24,TP3 ,TP30, TP31,TP33,TP34,TP41
V752346	PCB RGB I/O Q (I)CDX51	0001
V7730541	CHOKE RA NS 5.0UH Y	L102,L202,L302

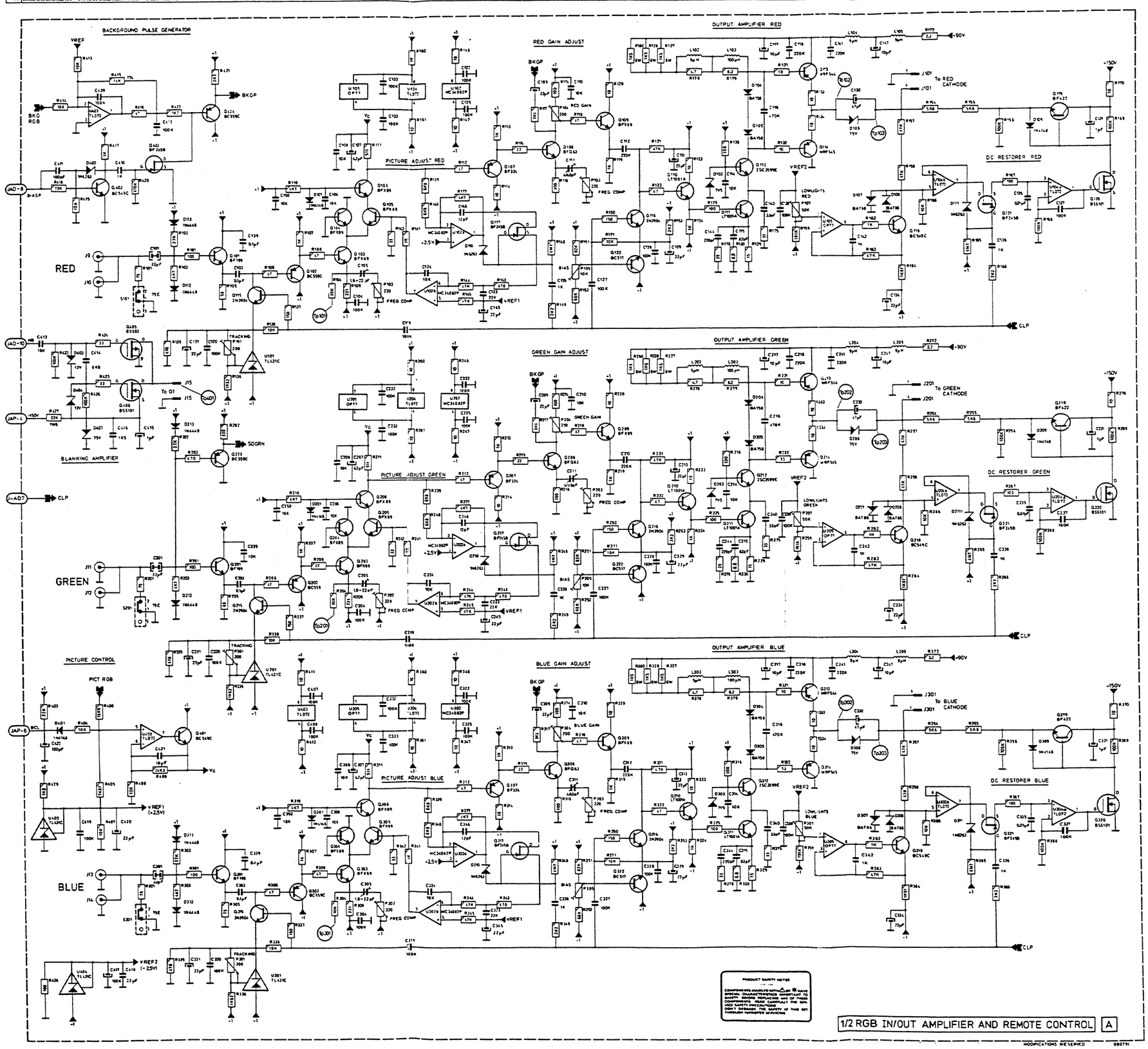
| | | |

R	92. 71.91.87. 89.90. 88. 93. 94. 95. 82.85. 68. 98. 96. 83.66. 99. 97. 74.70. 116.108. 72. 100. 67. 73. 84. 75. 86. 75. 81. 77. 78. 79. 102.101. 103. 80.65. 104. 105. 107.106. 64.
C	52. 51. 62. 65. 53. 63. 64. 54. 66. 67. 56. 55. 54. 57. 58. 59. 88. 69. 61 72. 78. 73. 71. 74. P3. P5. D48. Q17. A1.
MISC.	U7d. Q12. U6. D42. P4. U7c. U7a. D32. D38. U8. D39. P5. U7b. U7. D43. Q15. Q13. T4. D44. Q14. Q16. D45. D40. D41. T5. D46. D47. D36.

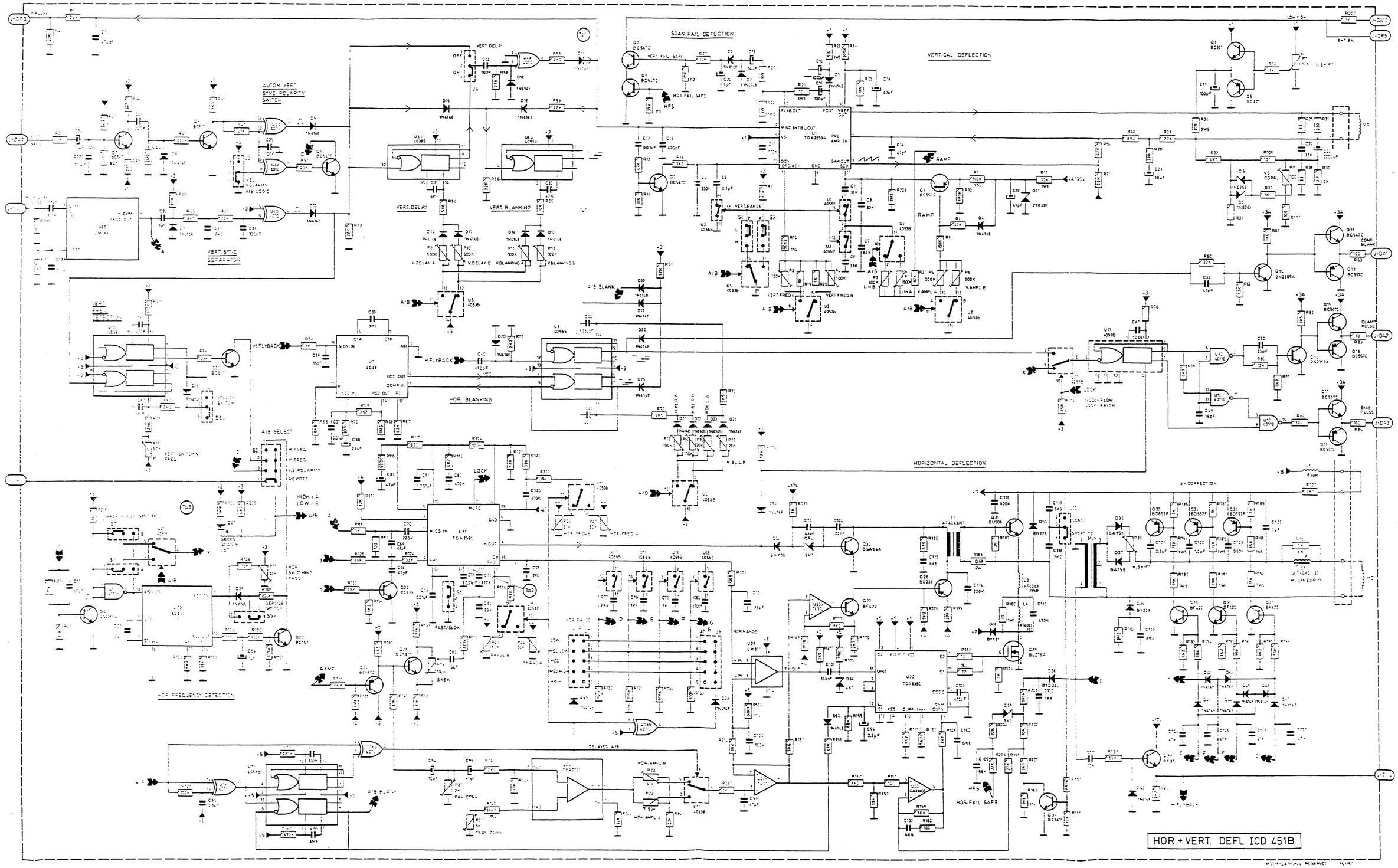


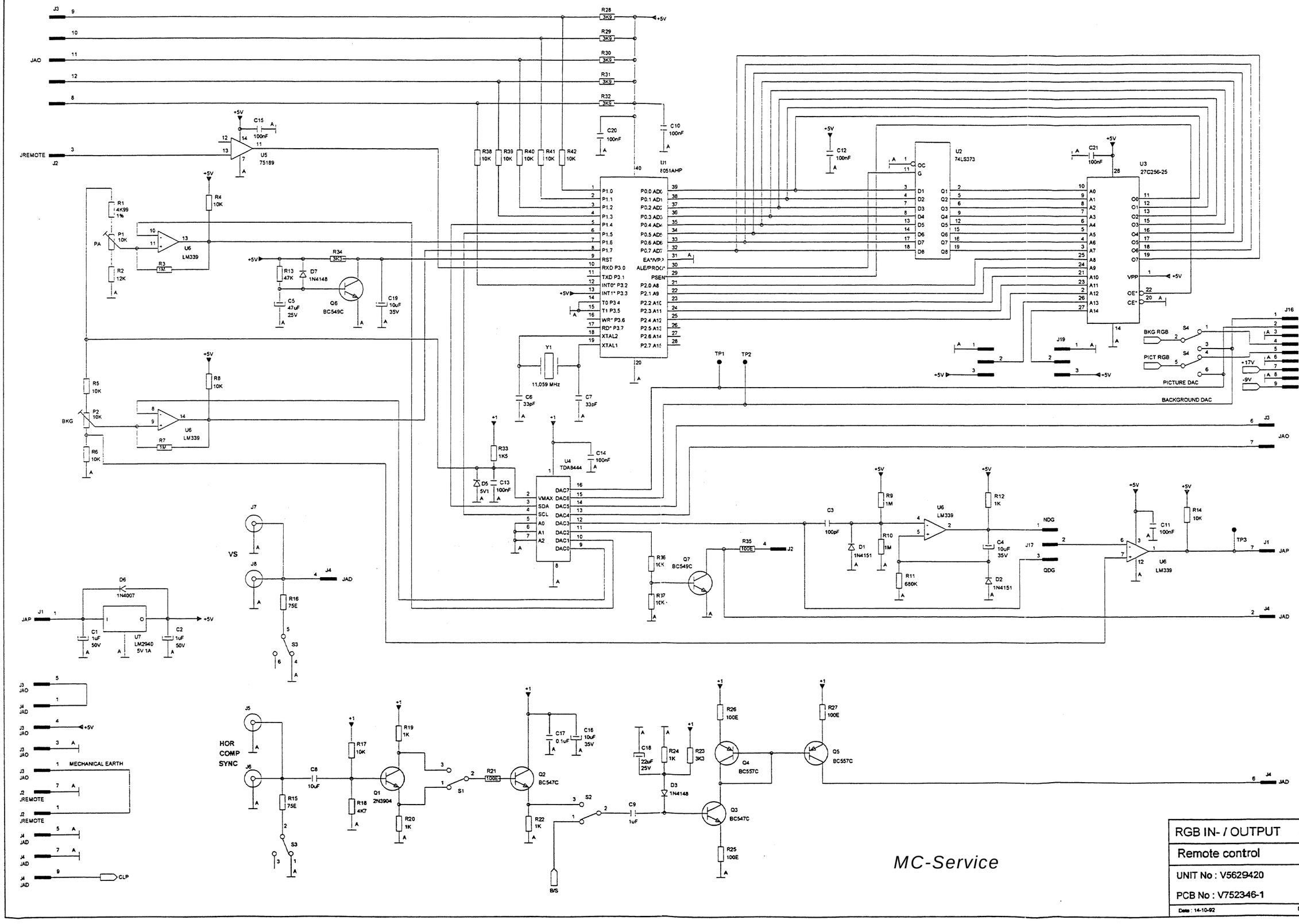
X RADIATION WARNING

After any service intervention the high voltage and EHT hold down adjusments have to be performed. P4 has to be resealed

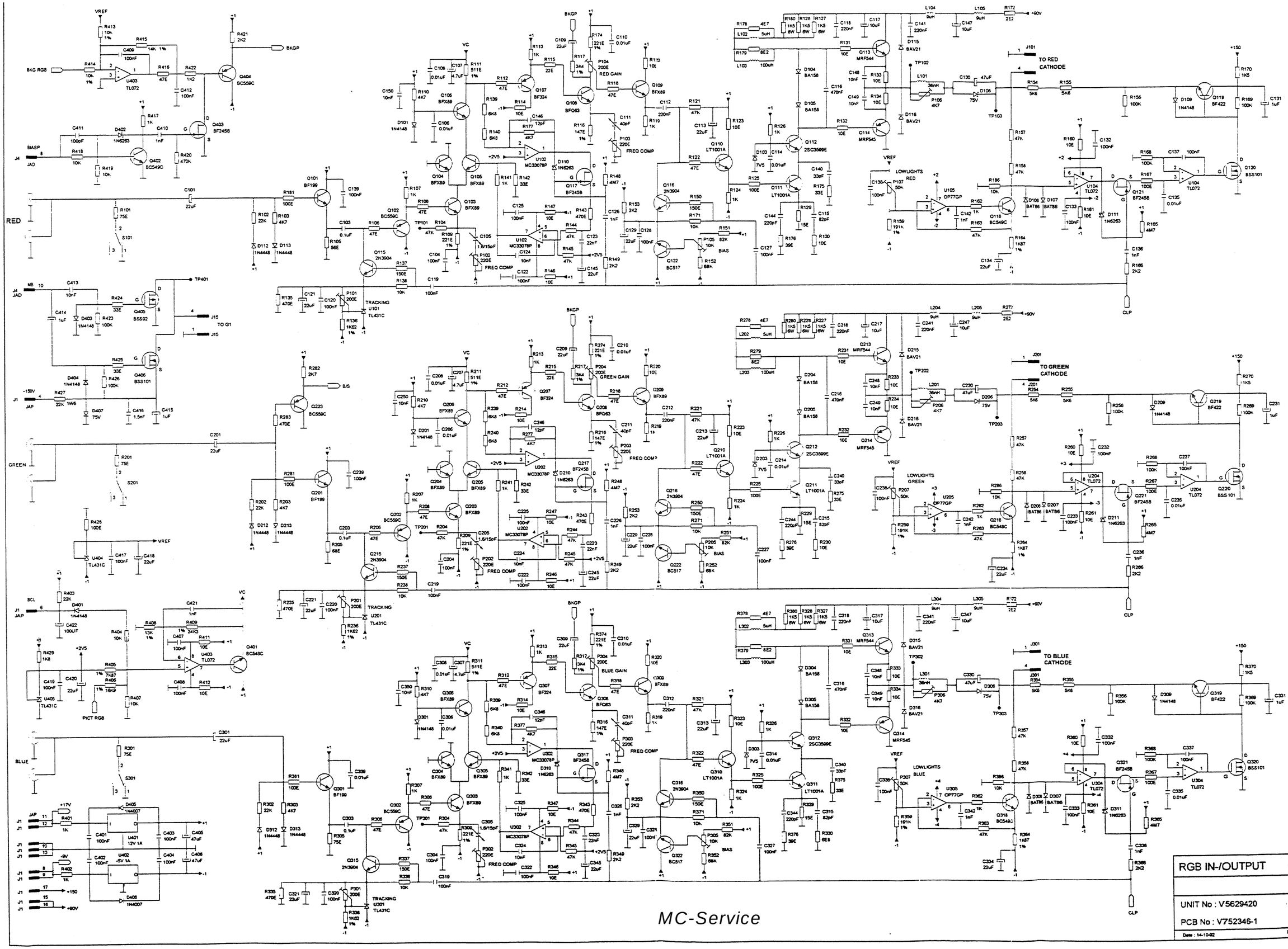

BACKGROUND PULSE GENERATOR
VREF
BKG RGB
BKGP
BIASP
RED
GREEN
BLUE
PICTURE ADJUST RED
PICTURE ADJUST GREEN
PICTURE ADJUST BLUE
RED GAIN ADJUST
GREEN GAIN ADJUST
BLUE GAIN ADJUST
OUTPUT AMPLIFIER RED
OUTPUT AMPLIFIER GREEN
OUTPUT AMPLIFIER BLUE
To RED CATHODE
To GREEN CATHODE
To BLUE CATHODE
DC RESTORER RED
DC RESTORER GREEN
DC RESTORER BLUE
LOWLIGHTS RED
LOWLIGHTS GREEN
LOWLIGHTS BLUE
BLANKING AMPLIFIER
PICTURE CONTROL
PICT RGB
SOGRN
CLP
VREF1 (+2.5V)
VREF2 (-2.5V)
+150V
-90V
1/2 RGB IN/OUT AMPLIFIER AND REMOTE CONTROL
A
MODIFICATIONS RESERVED

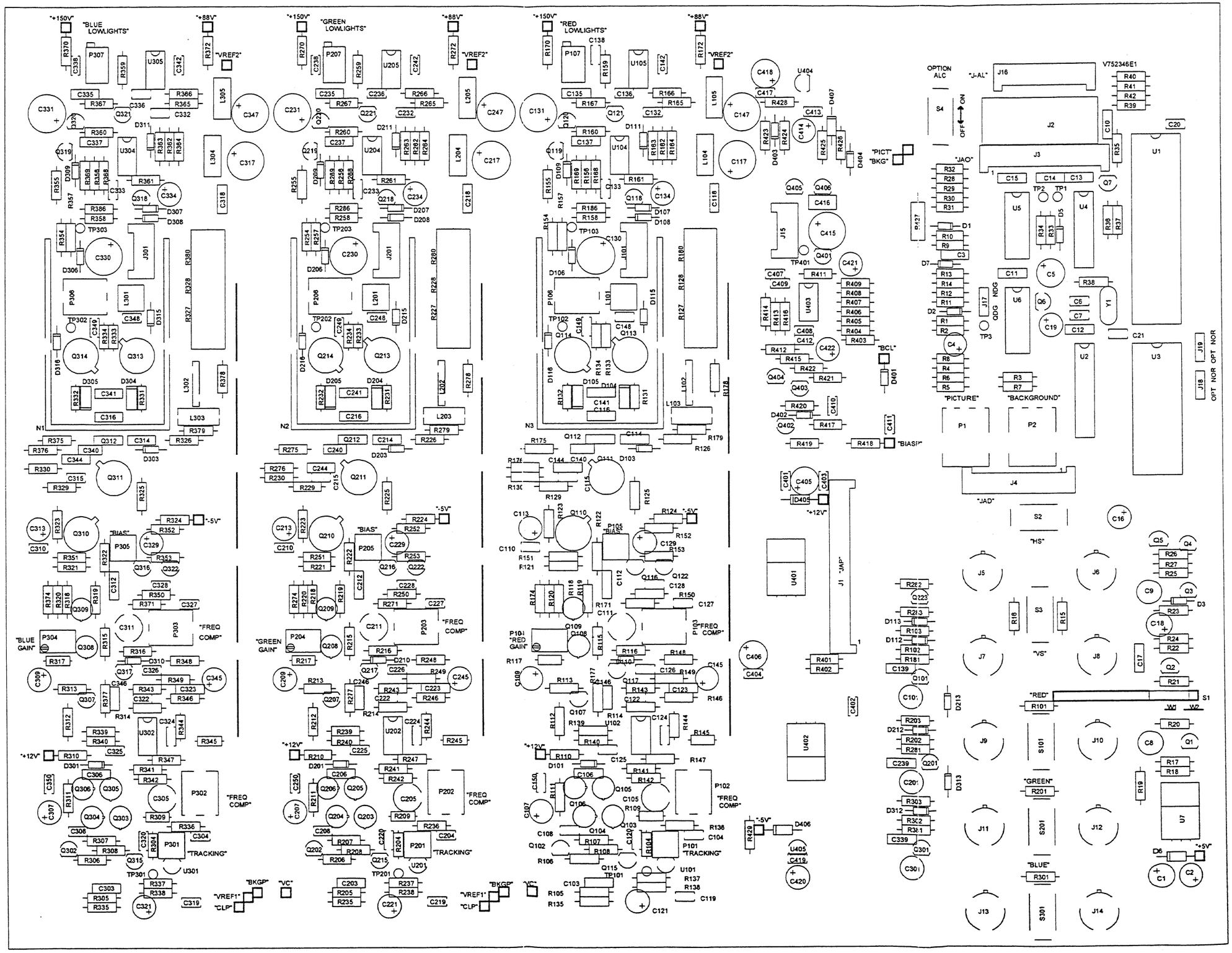
| | | |


SCAN FAIL DETECTION
VERTICAL DEFLECTION
AUTOM. VERT. SYNC. POLARITY SWITCH
VERT. SYNC SEPARATOR
VERT. DELAY
VERT. BLANKING
RAMP
VERT. FREQ. DETECTION
H.FLYBACK
HOR. BLANKING
A/B SELECT
HOR. FREQUENCY DETECTION
HORIZONTAL DEFLECTION
S-CORRECTION
HOR. + VERT. DEFL. ICD 451B



RGB IN- / OUTPUT	(I)CDX51
Remote control	Sheet 1/2
UNIT No : V5629420	
PCB No : V752346-1	
Date : 14-10-92	Drawn by : DDG-304


RED
GREEN
BLUE
TO RED CATHODE
TO GREEN CATHODE
TO BLUE CATHODE
TO G1
RED GAIN
GREEN GAIN
BLUE GAIN
FREQ COMP
BIAS
TRACKING
LOWLIGHTS RED
LOWLIGHTS GREEN
LOWLIGHTS BLUE
PICT RGB
BKG RGB
CLP
VREF
BKGP
VC
+90V
+150
-150V
+17V
-9V
+5V
BS
RGB IN-/OUTPUT
(I)CDX51
Sheet 2/2
UNIT No : V5629420
PCB No : V752346-1
Date : 14-10-02
Drawn by : DDG-304
MC-Service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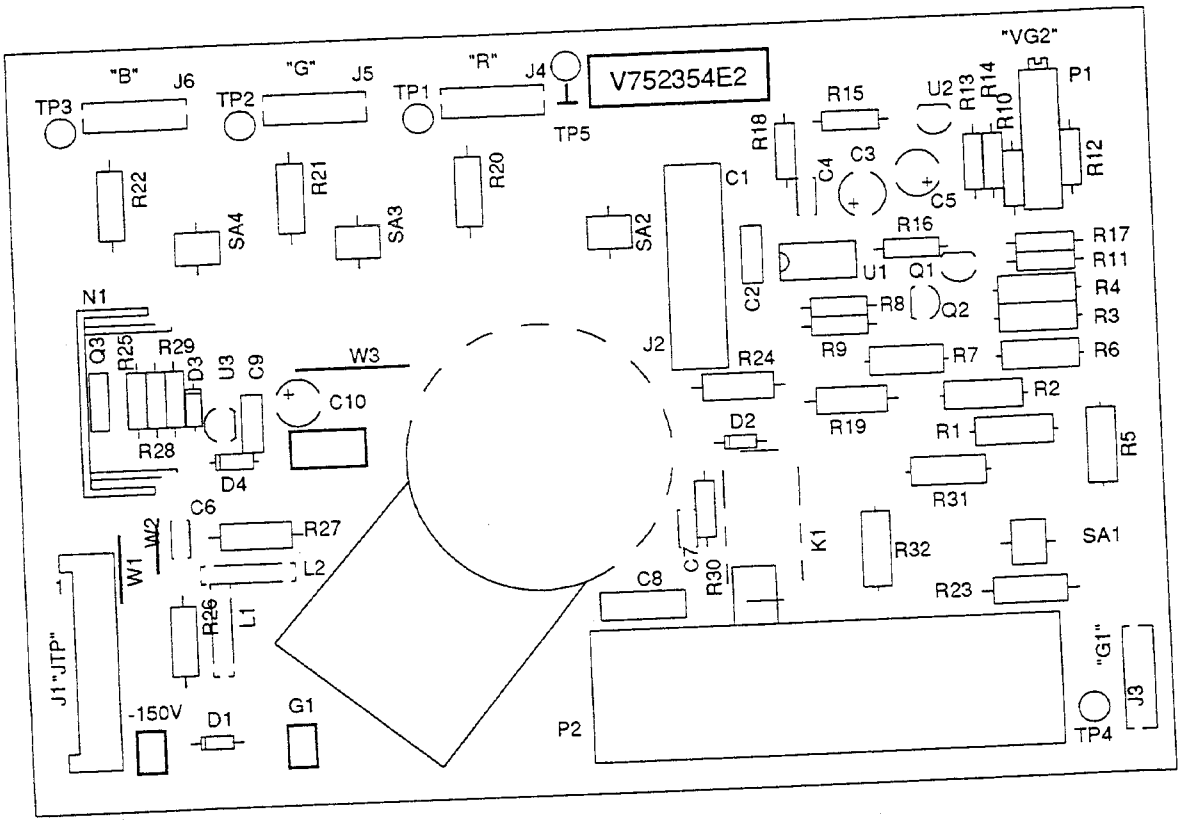
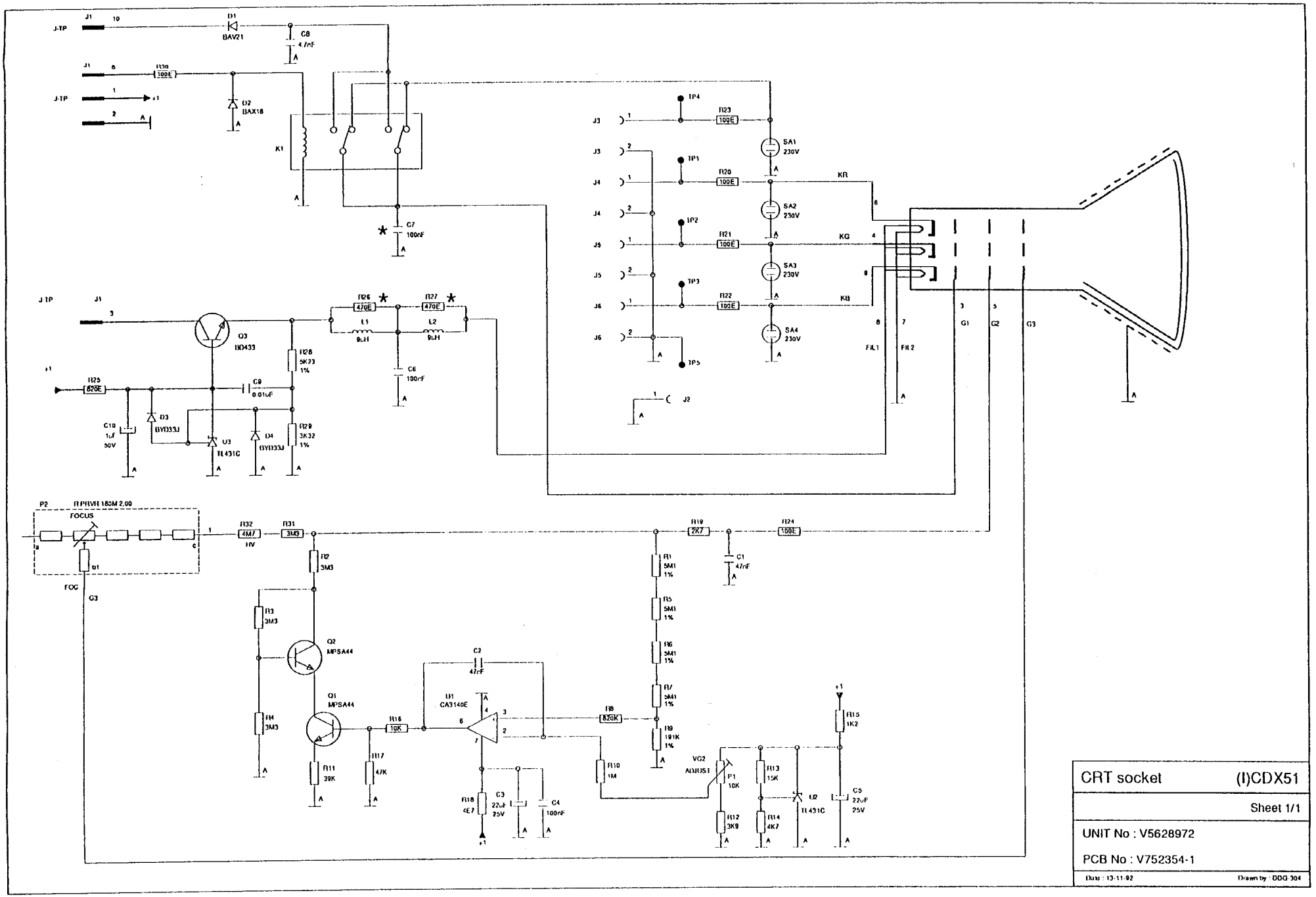
"BLUE LOWLIGHTS"
"+88V"
"VREF2"
"GREEN LOWLIGHTS"
"RED LOWLIGHTS"
"PICT"
"BKG"
"BCL"
"BIASP"
OPTION ALC
"J-AL"
V752346E1
"JAO"
"PICTURE"
"BACKGROUND"
"JAD"
"HS"
"VS"
"RED"
"GREEN"
"BLUE"
"JAP"
"-5V"
"+12V"
"BIAS"
"FREQ COMP"
"TRACKING"
"BKGP"
"VC"
"VREF1"
"CLP"
"BLUE GAIN"
"GREEN GAIN"
"RED GAIN"
OPT NOR OPT NOR
N1
N2
N3


V752354E2
"B"
J6
"G"
J5
"R"
J4
"VG2"
TP3
TP2
TP1
TP5
P1
R15
U2
R13
R14
R10
R18
R12
C4
C3
C5
R22
R21
R20
SA4
SA3
SA2
C1
C2
R16
U1
Q1
R17
R11
R4
R3
R8
Q2
R9
R7
R6
R24
R2
R19
R1
R5
R31
D2
N1
Q3
R25
R29
D3
U3
C9
W3
C10
R28
D4
J2
C6
R27
W2
W1
L2
L1
R26
C7
K1
R32
SA1
C8
R30
R23
J1"JTP"
-150V
D1
G1
P2
TP4
"G1"
J3



CRT socket	(I)CDX51
	Sheet 1/1
UNIT No : V5628972	
PCB No : V752354-1	
Date : 13-11-92	Drawn by : DDG 304

PARTS LIST OF THE CRT SOCKET UNIT
Order number of a complete unit : V5628972

Order number	Description	Item
V1011088	R CFFH 4E7 J 0W25	R18
V101224	R MF H100E J 0W5	R30
V101232	R MF H470E J 0W5	R26 ,R27
V101235	R MF H820E J 0W5	R25
V101237	R MF H 1K2 J 0W5	R15
V101243	R MF H 3K9 J 0W5	R12
V101244	R MF H 4K7 J 0W5	R14
V101248	R MF H 10K J 0W5	R16
V101250	R MF H 15K J 0W5	R13
V101255	R MF H 39K J 0W5	R11
V101256	R MF H 47K J 0W5	R17
V101271	R MF H820K J 0W5	R8
V101272	R MF H 1M J 0W5	R10
V102024	R CC H100E K 0W5	R20 ,R21 ,R22 ,R23 ,R24
V102041	R CC H 2K7 K 0W5	R19
V1026278	R MF H191K F 0W6 E4	R9
V1026506	R MF H 3K32F 0W6 E4	R29
V1026696	R MF H 5K23F 0W6 E4	R28
V104671	R HV H 4M7 J 0W5 3500	R2 ,R3 ,R4
V1046715	R HV H 5M1 F 0W5 3500	R1 ,R5 ,R6 ,R7
V107513	R MCE H 10K K 0W75 M20SS	P1
V1076181	R THV V 80M K 2W 13000	P2
V1115109	C EL RA 22M M 25E2 105	C3 ,C5
V1115469	C EL RA 1M M 50E2 105	C10
C112763	C CE MI 10N U 63E2	C9
V1127830	C X7R MU 100N K 50E2 125	C4 ,C6
V112833	C CE DI 4N7S400E3	C8
V114084	C POMERA 47N K 63E2 100	C2
C114602	C POMERA 47N M102E9 HV	C1
V1312611	TUBE SURGE PROT 230V AX	SA1 ,SA2 ,SA3 ,SA4
V131433	Q BD433 N P TO126	Q3
V131624	D BAX18 SW DO35	D2
V131627	D S BAV21 200250 DO35	D1
V1319033	D BYD33J FSR SOD81	D3 ,D4
V132500	Q MPSA44 N SS TO92	Q1 ,Q2
V133086	Q ACC HTSNK TO220	0002
V134018	U 431C TL TO92 P	U2 ,U3
V134120	U 3140 CA DIP8 P	U1
V306100	CH AX NS 9 UH	L1 ,L2
C311034	J CRT FBT SG11-13KV SKT	J2
V3135824	J FLT SUPPORT P 4 R1	0009
V3137100	J MT MBT P10 R1 FL BLK	J1
V315302	J EYE TEST LG	TP1 ,TP2 ,TP3 ,TP4 ,TP5
V315319	J TAB1 MBT H 6.3S0.8	0003
V315368	J TAB1 MBT H 3.3S0.5	0011
V324346	RLY 12V 2C BH DIP M	K1
K3263025	W HV 20K AWG20 SO UL3239	0004
Z346404	CD F2.50 P 4 MT - BK 160	0010
V348015	SLVU SHR D3.2/1.6 RD 20	0005
V3481034	WU JUMP 0.6 10.16	W2 ,W6
V3481044	WU JUMP 0.6 12.7	W1
V3481054	WU JUMP 0.6 15.24	R31 ,R32
V3481064	WU JUMP 0.6 17.78	W3
V362122	SCR D7985 M 3 X 8 S Z	0006
V366102	NUT D934 M 3 S Z	0007
V367502	WSHR D6798 A 3.2 S Z	0008
V752354	PCB CRT SOCK V2 CD651	0001